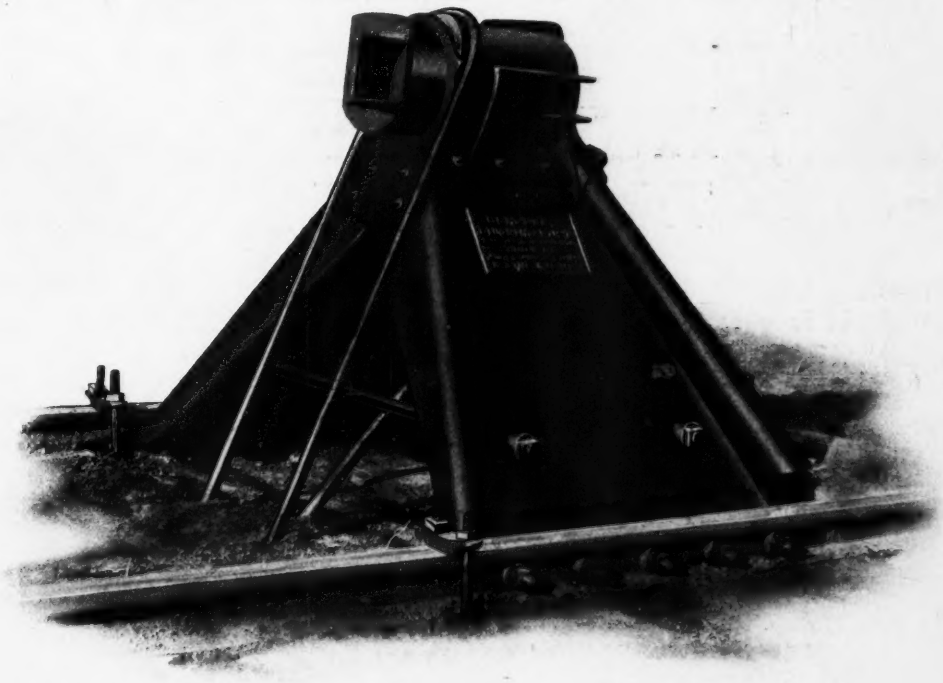
RAILWAY ENGINEERING AND MAINTENANCE OF WAY.

BRIDGES - BUILDINGS - CONTRACTING - SIGNALING - TRACK

New Series, Vol. IX
Old Series, Vol. XXVIII | *Chicago* | JUNE, 1913 | *New York* | No. 6

HERCULES
STEEL BUMPING POSTS



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Approved by the U. S. Government and installed on all of the Panama Canal towing tracks.

Railway & Traction Supply Company

Sole Manufacturers

Chicago, Illinois

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in his admonition that "there is no such word as fail," was unknowingly speaking of

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Can it be that YOU give no particular thought to the matter of TRACK TOOLS?

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They Eliminate Low Joints and Vibration, and Allow

Equal Expansion and Contraction at All Joints

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WATERBURY, CONN.

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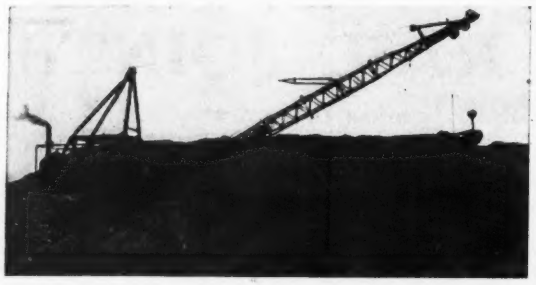

THIS CLASS 24 BUCYRUS DRAGLINE EXCAVATOR is shown making a railway fill for Morris, Shepard & Dougherty on the C., M. & St. P. Ry. near Andover, South Dakota. This machine for two months averaged better than one swing per minute and actually made as high as 84 swings per hour, working in heavy material. It carries a 100-foot boom and a 3½-yard bucket.

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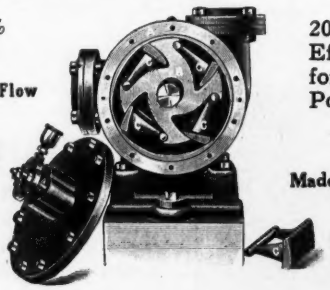

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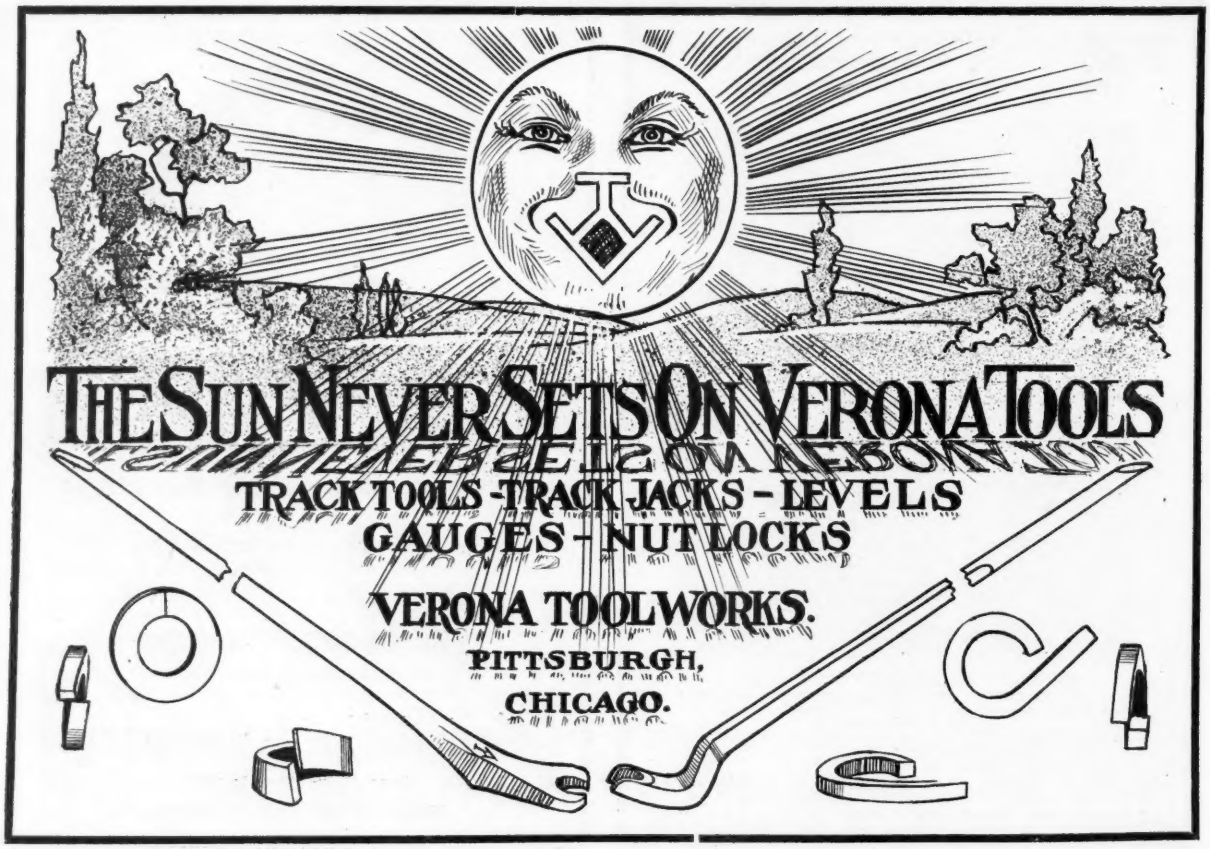

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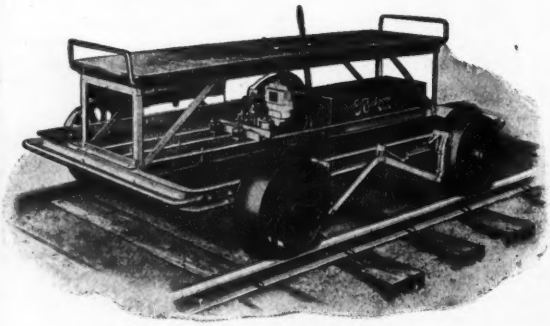

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Speed of 20 miles per hour.
Strongest possible construction consistent with light weight.

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Will accommodate 2 men when extension seat is attached.
Is ideal car for inspection—linemen, signalmen, etc.
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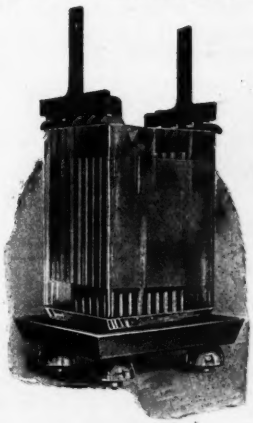

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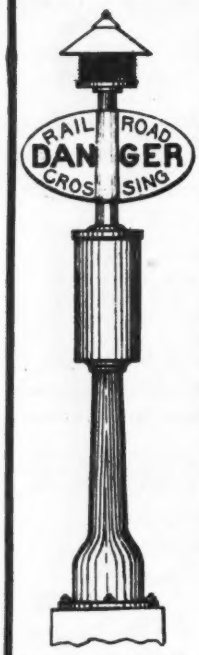

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Our Batteryless

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CROSSING BELL

Is being made Standard on many Steam and Electric roads because it requires

NO BATTERY
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NO RAIL BONDING
NO TRACK CIRCUITS
NO CONNECTION WITH TROLLEY OR HIGH TENSION CIRCUITS
NO CONNECTION WITH EXISTING SIGNALS
NO OPERATING EXPENSE
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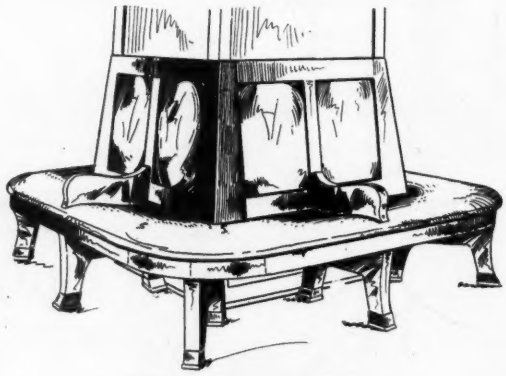

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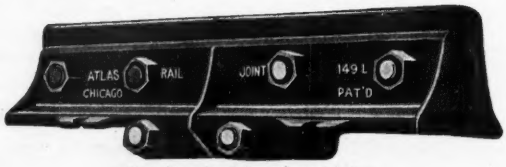
Special work estimated

ATLAS RAIL JOINTS, TIE PLATES AND BRACES

ATLAS SWITCH STANDS AND CAR MOVERS

Atlas Tie Plate

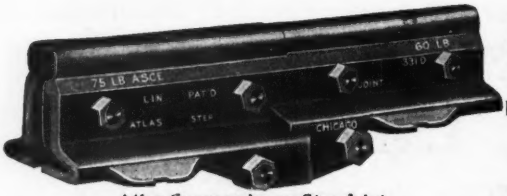
Atlas Primer and Surfacer for Your Cars



Atlas Standard Suspended Joint

Atlas Compromise and Insulated Joints

Made either of Atlas Special Malleable Iron or of High Grade CAST STEEL



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Made to Fit any Combination of Rails, Tee or Girder

Made Either Suspended or Supported

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Sample free on request

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Are Built at Our Plant and Not Just Assembled

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THE WYOMING SHOVEL WORKS WYOMING, PA. U.S.A. REG. U.S. PATENT OFF.

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Wyoming Shovel Works
WYOMING, PA.
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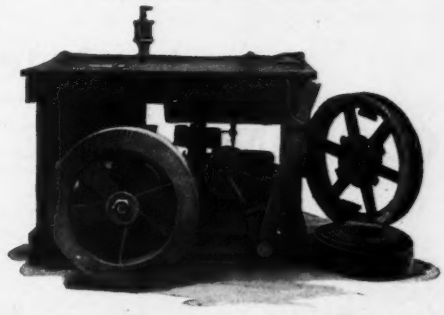
"Ride While You Pay"

$25 Cash with Order

buys this

Mudge Engine Equipment for Hand Cars



Thirty Minutes from Crate to Service

Use this equipment on your hand car and "Lighten your Labor" while you pay the balance at the rate of $10 per month. Shipment can be made within 24 hours after order is approved.

You can apply the Mudge Engine Equipment to your hand car in 30 minutes. It is so simple that anyone can understand it. The only tools you need are, a saw, a brace and bit, and a monkey wrench. All you have to do is to bore a few holes in the floor in which to bolt the Equipment to your car, fasten the pulley to the front axle, and lace the belt around the pulleys. The dry cells are wired to the timer, and the gasoline tank is connected up to the engine when the Equipment reaches you. It is ready to run in half an hour.

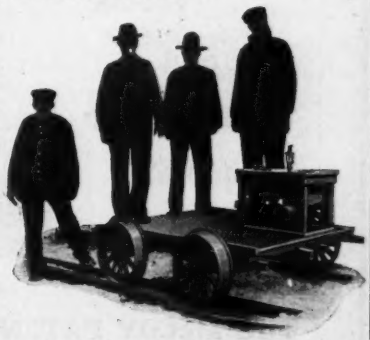
This is the same 2 cycle air-cooled 4 Horse Power engine that has been in service seven years and is running successfully on hundreds of Mudge-Adams Inspection Motor Cars. Its power and durability have been proven.

This engine has *only three moving parts* so that there is hardly anything to get out of order, and it can be run by anyone without previous experience.

"Facts for Foremen," a circular completely describing the Mudge Engine Equipment will be sent to anyone on request.

Act today. Send your order now and get as much use of the engine as possible this year.

A cash refund is allowed to all owners of our Engines or Cars on every Engine Equipment they are able to sell.



Mudge Engine Equipment applied to hand car
Runs either forward or backward

Mudge & Company, ORDER COUPON
409 Railway Exchange, Chicago.

I want to buy one of your Mudge Engine Equipment outfits for my hand car and will pay for it
(Check the plan you wish and draw a line through the others)
$110; $25 with this order and $10 per month.
$105; $40 with this order and $15 per month.
$100; Sight draft attached to bill of lading.
$100; Less 3% for cash herewith.

Please send the outfit to me with shipping ticket made out as follows:

Signed.....

Occupation.....*R.R.*.....

Town.....*State*.....

SALES SERVICE COMPANY, ADVERTISING—CHICAGO 18

Reinforced Concrete Tanks

ARE NO LONGER AN INNOVATION IN RAILWAY SERVICE.

We Guarantee Our Tanks

UNDER

TRUST COMPANY BOND

TO BE

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OUR TANKS MAKE GOOD BECAUSE THEY ARE

Properly Designed

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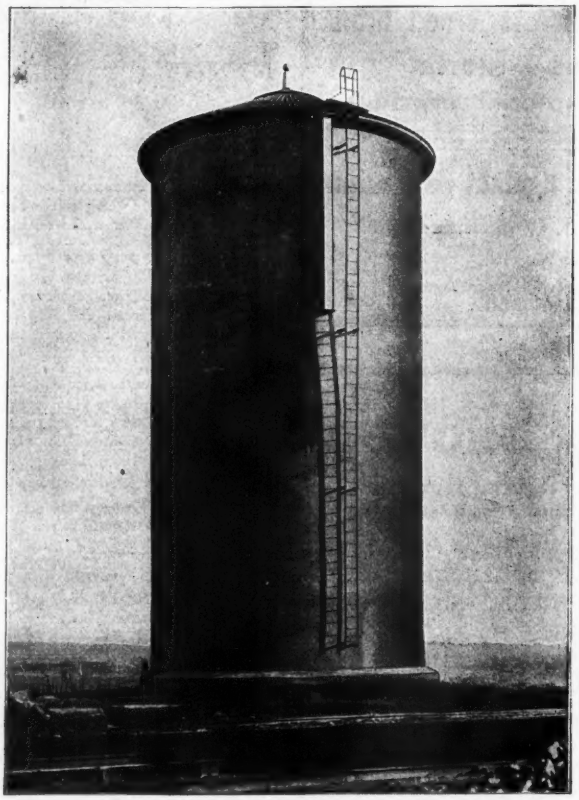
Carefully Constructed with Best Materials, Forms and Workmanship Obtainable



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Satisfactory in Service

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Attractive in Appearance

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Economical

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THE McCOY PATENT FORMS & METHODS OF ERECTION ELIMINATE IMPERFECTIONS.

WRITE FOR BOOKLET OF CONCRETE FACTS CONCERNING CONCRETE TANKS.

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A Monthly Railway Journal

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In remitting, make all checks payable to the Railway List Company.
Papers should reach subscribers by the twentieth of the month at the latest. Kindly notify us at once of any delay or failure to receive any issue and another copy will be very gladly sent.
This Publication has the largest paid circulation of any railway journal in the Maintenance of Way field.

Entered as Second-Class matter April 13, 1905, at the Post Office at Chicago, Illinois, Under the Act of Congress of March 3, 1879.

New Series. Vol. 9
Old Series Vol. 28
Chicago, June, 1913 No. 6

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New B. & O. Treating Plant.

THE ELIMINATION of pressure pumps for forcing preservative oil, solution or emulsion into timber, in design of Green Spring plant, is a new feature, and one which deserves more than passing mention.

The pressure on the preservative is obtained by means of an ordinary air compressor, which is necessary even in plants which use pumps. The capacity of the compressor naturally must be somewhat greater, on account of greater demands on it.

Anything which tends to simplify the machinery or lessen the number of machines is manifestly of advantage in a treating plant or, in fact, any plant. The cost of installation is decreased, and maintenance and repairs are cheapened and simplified.

Compressor air for power transmission has constantly been applied to new conditions. In some ways it rivals electricity, and this is especially true with small portable tools.

The simplification of pressure production in the timber plant to that furnished by one machine or one type of machine, is indeed a notable improvement, and is a radical departure from established practice.

Publicity.

IT IS ONLY recently that many of our large corporations have begun to realize the value of publicity and many concerns even yet, have not realized the value or necessity for complete publicity.

Anyone who doubts the value of publicity can obtain some astonishing information by studying the growth of the cement industry. When it is realized against what odds the concrete people have contended, the growth has indeed been remarkable.

The exceptional opportunity for poor concrete work has ever given the competitors of concrete a dangerous weapon, and they have taken exceptions and isolated cases and attempted to make them seem typical.

The policy of the cement manufacturers throughout, however, has been to boom concrete, and to say nothing of other materials, and therein lies one of the causes for the success attained. The policy of leaving the other building materials severely alone, and talking cement on every occasion has accomplished the desired result. The fairness of this attitude is now being favorably appreciated by many people who were formerly influenced adversely.

Real publicity is giving out broadcast the actual conditions obtaining. And a settled policy of this kind tends to purge out objectionable features. We have numbers of large corporations whose businesses have been built up by obtaining the confidence of the public, and by striving to merit that confidence. The result of a policy of publicity is to gradually rid a business of dishonest practices.

A few of the methods of the cement people in getting and keeping before the public, have been (1) a national association, (2) numerous cement shows, (3) quantities of valuable literature, (4) trade publications and newspapers.

The National Association of Cement manufacturers collects and disseminates information, and its organization is actively engaged, not in the attempt to belittle other building materials, but to show the advantages of concrete and to constantly increase the uses to which it may be put.

The cement shows have attracted great attention. Collectively, these shows probably represent the largest exhibit of any body of supply men. The educational value of such shows is well recognized.

The literature gotten out by the individual cement companies, much of it, is of great value to the technical man. Practically all of it is of use to the practical man. The work of the association along this line has also been of value. The idea of making the technical and practical descriptions advertise the product, has proven to be a valuable one.

Many examples might be cited beside the one herein given. Publicity is extremely valuable if facts only are dealt in; then will there be no rebound or reversal of the good effects accomplished.

The Fiscal Year.

THE end of the fiscal year in railway business comes at a time which causes a good deal of trouble and inconvenience to both the construction and maintenance departments, and actual loss to the railways.

All maintenance men are desirous of getting their extra men started, and work under way, as early as possible in the Spring. The track is in need of prompt attention after the frost is out of the ground, and in addition to that, it is much easier to fill out gangs early in the Spring than later when all classes of work open up. Sometimes the gangs are increased and just whipped into good organization, when the order comes to reduce forces until the beginning of the new fiscal year.

Such orders reduce the entire maintenance force, and the laborers promptly seek other jobs and are not available when the order is given to again increase the gangs. Even if the laborers were unable to obtain other work in the interval, they will probably be disgusted and refuse to again hire out for railway work. The result is that new men must be hired, taught the work, and after several weeks again the organization becomes efficient, or, in other words, the forces again become organized. Half of the Summer is gone before the maintenance forces begin to accomplish efficient work. It is extremely discouraging to maintenance men to have to work under such conditions, and a lack of interest would not be surprising.

In the construction department the effect of holding down expenses, and making decisions as to which jobs will be put through, causes even greater inconvenience and waste. Forces are liable to be cut and work discontinued on many general, detail and construction plans. If part of the force is laid off, green men must be broken in later, (or at any rate men unacquainted with the standards and myriad differing details) when work is started up and everything is wanted "at once." Material is guessed at, ordered and rushed to the job before detail plans are finished. Then it becomes necessary to change the material or conform the design to the materials on hand. Either course is expensive and unsatisfactory.

Work poorly planned is very expensive; this refers to both office and field planning. If it is attempted to start work, and get out the plans as the work progresses, there result multitudinous changes in the work. Much work is absolutely wasted, and the tendency is to make the entire force careless of the amount of work accomplished or the cost of same. One railway man had become so used to this kind of thing that his motto was, "The less you do the less you will have to undo."

Starting work late causes the construction department to have the same difficulties as the maintenance department in obtaining men.

From the viewpoint of economical construction and maintenance, it appears that the fiscal year ends at just exactly the wrong time of the year. If this date could be shifted two or three months ahead it would greatly ease the overload being carried by those who have labor difficulties. No one will deny that the labor situation is acute, and that those in charge of labor should be given help wherever possible.

It is desirable, in any case, that a change of policy of some sort should be made, which will allow railway labor forces to be hired early in the Spring, and be kept steadily at work through the most advantageous seasons.

Perfection.

IT IS AN amiable failing of human nature for a man to "rest on his laurels" after having attained a certain degree of success. A great man expressed a truth when he said, "We are all as lazy as we dare be," although there are undoubtedly many men to whom this will not apply to any great degree.

When we tackle a new proposition all our interest is concentrated on the work; there is a certain novelty which compels and holds the attention. And after the task has been accomplished in a satisfactory manner, the responsible head is entitled to some relaxation from the heavy strain undergone. But it is still possible in every case, to discover pointers and new refinements which were not discernible in the rush of the work.

The ideas expressed in many of our modern machines is the master thought of a great inventor. But how many of these machines were perfect in their first conception and realization? Probably none. The development into a dependable apparatus has been through constant endeavor, and improvement, by the originator and many others.

Sustained effort is a necessary qualification for that man who expects to continually advance. Hines says that "The attainment of the ultimate (perfection) must extinguish existence as surely as the variable of mathematics would be wiped out if its limits could be reached."

The attainment of perfection, or an illusion that one has attained perfection, "extinguishes" his real interest, and hence his possibility of becoming of greater value in his present station.

Flood Water Channels.

THE ACCOUNT of the damage wrought by the recent flood in a section of Indiana, described on another page of this issue, brings to mind one of the elementary laws of river flow.

It is a matter of common knowledge, that, during flood times when the water overflows a river bank, thhe current will cut across the bottoms in a straight line, (in places where the topography presents no obstacles), instead of following a long bend in the river.

The reason for this is perfectly apparent—the fall between the two points is sharper over the short than over the long course. It would seem, however, that this possibility is often overlooked in the design of waterways in the roadbed.

In one case of this kind, the farmers well knew that the creek left its bed and cut across the bottoms at one of these bends, and several of them warned the company forces and advised a substantial pile trestle where the water took its path in the spring freshets. However only a small box culvert was provided, and the track and roadbed was washed away in the spring of every year, until the track was put up on heavy rip-rap without ballast, for a hundred feet each side of the culvert.

Notwithstanding these facts, a second track built in the same valley, about a quarter mile from the first, was left entirely without a waterway.

In the case of a low, flat bottom, is is sometimes almost impossible to provide an efficient waterway where the embankment is low and the water spreads out into a very wide shallow stream. However, in cases of this kind, the construction plans should provide fully for promptly riprapping the embankment and taking such other precautions as will minimize the loss on account of the high water.

Specialization.

IN AN ADDRESS delivered at the Railway Conference in connection with the dedication of the transportation building of the University of Illinois, May 8, Albert Reichman, president of the Western Society of Engineers, called attention to the need for high specialization among engineers. In order that this need be not taken too literally, however, he points to the expert in track construction and maintenance and states that such an engineer should be well versed in the developments in motive power and rolling stock which uses the track. The university training of the engineer is so broad as to allow of the graduate entering upon the practice of almost any branch of his profession, but in order to excel he must choose a comparatively narrow field of activity in order to become thoroughly proficient therein.

The successful engineer, however, sooner or later reaches a position where he must direct work of broader nature and on account of his specialized experience he may find himself lacking in knowledge demanded by the new position of authority. If he has not been a recluse he has, however, fitted himself, in a way, for the broader field by association with his fellows in as large a number as possible by attending the meetings of technical societies and associations. He thus is enabled to absorb much of general application without losing that gained by specialization. He is also in a position to secure the assistance of other specialists and to take charge of their work in a broad way. He becomes a chief in every sense of the word discharging the duties of a position which calls for anything but specialized knowledge.

Advice to specialize must, therefore, be taken by the engineering college graduate not too literally. To attain eminence he must first specialize but to take advantage of the opportunity offered as a result of expert attainment he must have wide general knowledge, which may be gained in many ways not the least important of which is through the technical association.

Many specialists in the engineering departments of American railways have risen to positions even beyond that of chief of the department through their ability to direct work of the broadest scope. We are frequently surprised by exhibitions of knowledge, on the part of railway engineering officials, entirely foreign to the field of their specialized activity. Such men usually arrive not only to eminence but to preeminence in the engineering profession.

CORRESPONDENCE.

Editor Railway Engineering:

Papers are occasionally published on subjects of public and professional interest which are entirely unworthy of answer, and even unworthy of comment or notice, except for the baneful influence of such papers on that portion of the public which does not have the time or inclination to look more deeply into the subject discussed.

A paper of this kind was recently presented before a local society in one of our cities, and abstracts from the paper published in the press. In mentioning this paper I am studiously attempting to keep the title and name of the author concealed, so that those who read this letter will have as little knowledge of the subject as the author of aforesaid paper apparently possessed. Furthermore, advertising space is worth money, and the undersigned being a poor copywriter, does not care to advertise either the paper or its author.

Ridicule is a poor and cowardly answer to argument, but where there is no argument to answer, ridicule is a proper weapon to use against the ridiculous.

A ray of light with reference to the subject treated is given by stating that the paper informs us that engineering and interest on expenditures during the period of construction are "imaginary" items.

Possibly the personal work of the author may have convinced him that engineering was imaginary; however, there is a large number of men engaged in engineering pursuits by the various corporations at large expense, and their services are considered valuable and necessary by both the corporations and the thinking portion of the public. The fact that estimates of the amount required to cover these services vary, does not make the services imaginary. With equitable minded men on both sides of the question, the errors in unit costs for any items of expense can be adjusted by comparisons with actual costs of a number of cases of similar construction.

The only case that can be brought to mind where the interests on investment during construction is an imaginary expense is in the "building of air castles in Spain."

Money withdrawn from its channels of earning and paid out during the period of construction certainly loses its earning power until usage or operation of the plant begins, and is thus an expense to the investor.

Fortunately, the greatest students of the subject and our national government in both the legislative and judicial departments recognize this fact.

Where politics are removed from the question and the representatives of both parties meet with a view to a just and equitable settlement of disputed points, the ultimate result is fair to both the public and the corporation.

A. K. Shurtleff.

The city council of Tampa, Fla., has agreed to permit the Atlantic Coast Line to run its tracks through the racetrack on the city's property and to cross the river by a route more direct than the present one. A new bridge will be required.

The Canadian Northern has filed plans for the $1,000,000 tunnel under the business section of Vancouver, B. C., between the Vancouver depot and False Creek freight yards, to eliminate grade crossings. The tunnel will be single track; length, 3,800 feet; height, 19½ feet; breadth, 16 feet; average depth below surface, 35 to 40 feet.

New Treating Plant at Green Springs, Virginia

A Notable Feature of this Plant Is the Absence of Preservative Pressure Pumps

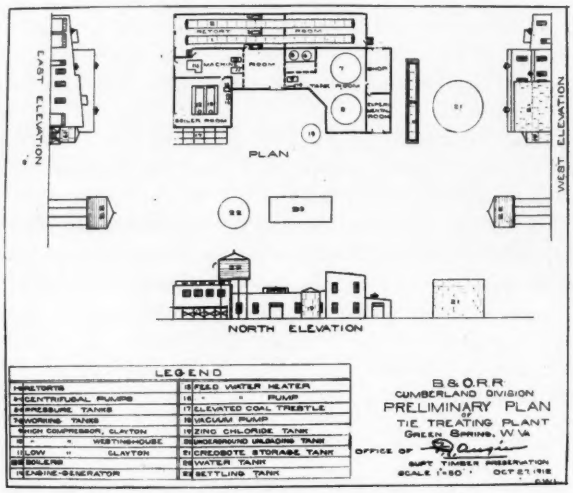
By F. J. Angier, Superintendent of Timber Preservation, Baltimore and Ohio R. R.

The Baltimore and Ohio R. R. has put into operation a new timber treating plant which has just been completed at Green Spring, W. Va. The new plant is one of the most complete and modern timber-treating plants in America. It covers 60 acres and is situated close to large areas of timberland along the South Branch Valley of the Potomac River. The requirements of the Baltimore and Ohio system approximate 2,500,000 ties annually for renewals, and with the new plant in operation a large proportion of these ties will be treated by the company. Other timber for railroad use will also be treated at the plant.

The timber-treating plant is equipped with two treating cylinders, or retorts, as they are commonly called. These retorts are 7 ft. in diameter and 132 ft. long, made of ¾-in. steel, and built for a working pressure of 175 lbs. per sq. in. Each of the retorts rests on 9 concrete piers and is securely anchored to a center pier with six 1¼-in. bolts. On the remaining eight piers the retorts rest on cast-steel saddles. Between the saddles and an iron plate imbedded in the concrete, are nests of steel rollers, each nest being made of three rollers, 2 ins. in diameter and 10 ins. long.

At each end of the retort is a door which swings on steel rollers and can be opened and closed easily by one man, notwithstanding the weight of 6,400 lbs. each. The door consists of a steel frame with flanged steel dished head one inch thick. The retorts are equipped with heating coils and also with perforated pipes. The pipes are used to obtain a more perfect distribution of steam when green timber is being artificially seasoned, as well as for the circulating device used in the Card process.

The main building of the plant is of steel frame construction with corrugated iron sides and concrete roof. The floors of the building are of cement, and the concrete basement is so constructed that should any of the preservative be spilled it can be recovered. In the basement is a concrete sump, equipped with an electric device which indicates to the engineer in charge when the sump is full. The sump is emptied by means of an ejector, the liquid passing into a settling tank about 50 ft. from the building. The settling tank is also of concrete construction, with a width of 20 ft., length of 50 ft. and depth of approximately 10 ft. The tank has four compartments and after the drainings from the plant enter the first compartment, the liquid is forced to travel through each of the other

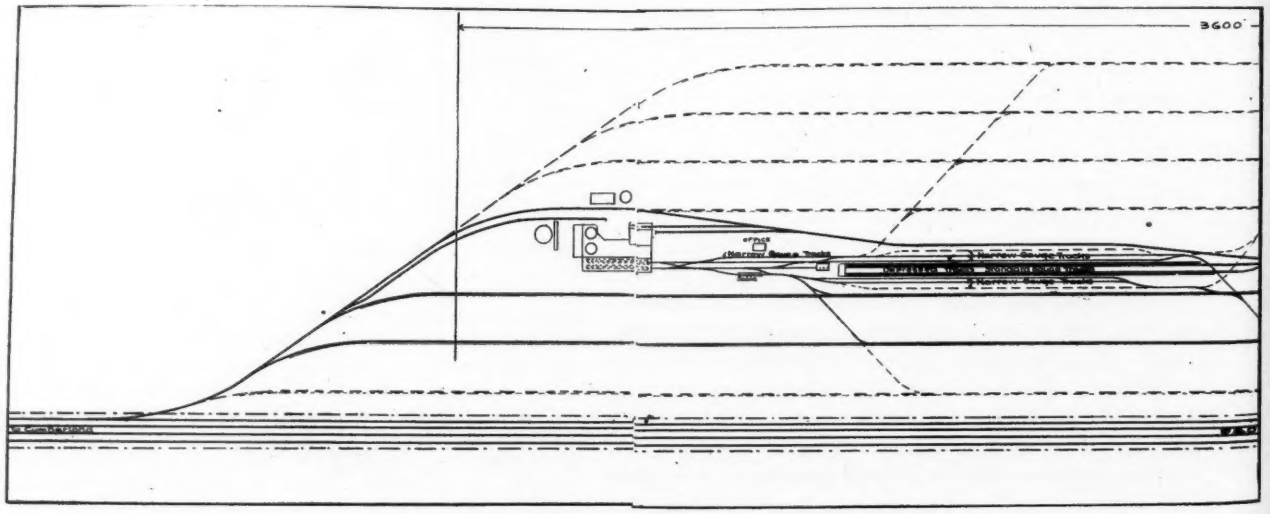


Plan and Elevation, Green Springs Treating Plant.

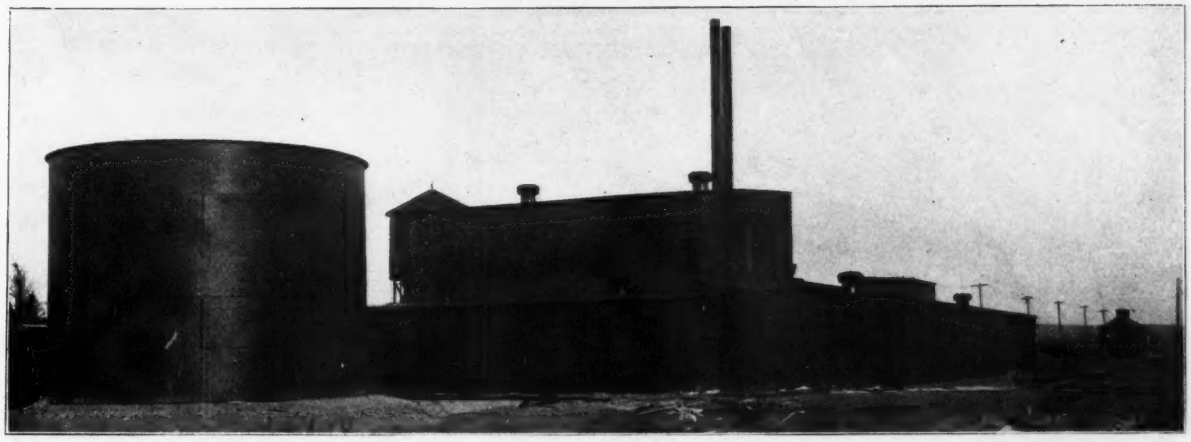
compartments in a circuitous path to the last compartment. By this time any creosote carried from the plant falls to the bottom, because of its greater specific gravity, and enters a well in the bottom of the last compartment of the settling tank. Here a bilge pump, operated by electricity, picks it up and carries it to an underground tank, and then by compressed air it is carried into the working tanks.

The boiler room is situated adjacent to the main building, the dimensions of the room being 30 by 40 ft. The boiler room contains two horizontal return tubular boilers of 150 H. P. each, built for 125 lbs. per sq. in. working pressure. Space is provided in the room for a third boiler to be installed when the requirements of the railroad justify the enlargement of the plant. A boiler feed heater, injector and feet water pump complete the equipment in the boiler room.

The oil storage tank is 40 ft. in diameter by 30 ft. high, having a total capacity of 280,000 gallons. There is also a storage tank for a concentrated solution of zinc-chloride, the diameter of which is 15 ft., height 20 ft. with a capacity of 25,000 gallons. The oil storage tank is equipped with a system of heating coils made in four sections, the combined heat-



Layout of Green Springs Treating Plant, B. & O. R. R.



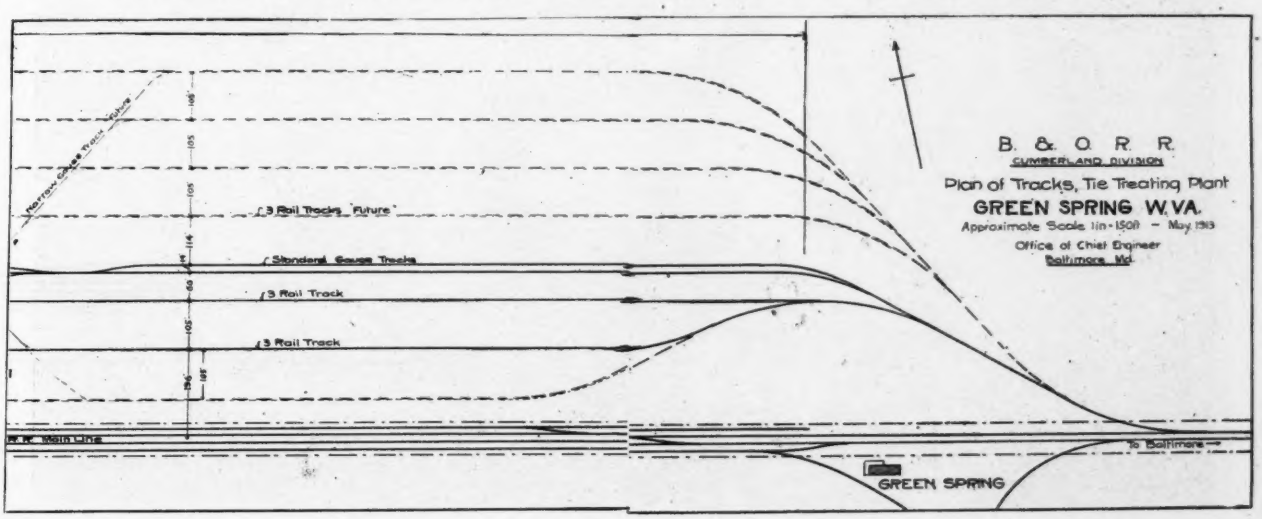
General View, Green Springs Plant.

ing surface of which is 500 sq. ft. An angle stem thermometer is placed in the side of this tank, enabling the operator to keep the oil at a constant temperature of about 120 deg. Fah.

Near the storage tank is an underground unloading tank, 6 ft. in diameter by 60 ft. long. The tank is enclosed in a concrete pit, which will prevent waste of the creosote in the event that leakage occurs. The tank will withstand an air pressure of 50 lbs. per sq. in., and creosote is forced from this tank into the storage, or working tanks, by air also. The working tanks and pressure tanks are all located inside the building, so that they can be kept warm and the temperature of the working solution retained at 190 deg. The locating of these tanks inside the building also accomplished a further economy in the consumption of fuel, particularly in cold weather.

The working tanks are 24 ft. in diameter by 20 ft. high, each having a capacity of about 68,000 gallons. They rest on concrete foundations 6 ft. above the floor line, being equipped with cast-iron radiators for heating the solution. Each tank has three sets of radiators working independently of each other. The combined heating surface of the radiators is 441 sq. ft. Each tank is also equipped with air coils for agitating a mixed solution of creosote and zinc chloride. Air is admitted at 100 lbs. pressure, and distributed in such a manner as to completely mix the solution in from two to five minutes. The tanks are also equipped with mercury gauges which show the true reading in tub feet and gallons, regardless of the temperature. This avoids the necessity of making correction for temperature readings with these gauges. Besides the mercury gauges each tank has a syphon regulator which regulates the steam supply to the radiators and automatically opens and closes the steam supply valve in maintaining the required temperature.

The pressure tanks are 8 ft. in diameter and 14 ft. high, made of seven-eighths-inch steel for a working pressure of 175 lbs. They are in reality a combination of pressure, measuring and drain tanks, and are located in such a way that they are readily filled while the treating cylinders are being filled, preparatory to treating a charge of timber. Compressed air is then applied through the top of these pressure tanks and the preservative is forced through a pipe in the bottom connected with the cylinders. Pressure is maintained until the required absorption is obtained in the timber, after which the valve is closed and any preservative remaining in the tank can be returned to the working tank by means of the compressed air already in the pressure tank. There is also a sufficient amount of compressed air in this tank to force all of the solution in the treating cylinder back to the working tank. The tanks are also used for measuring purposes, being equipped with mercury indicators which show the amount of solution, thus informing the engineer as to the amount of solution going into the timber he is treating. They are also used as drain tanks to catch and measure the solution taken from the timber during the vacuum and draining process. The bottoms of the pressure tanks are only slightly lower than the treating cylinders; and though all of the drainings from the charge would not flow into the pressure tank by gravity, this is



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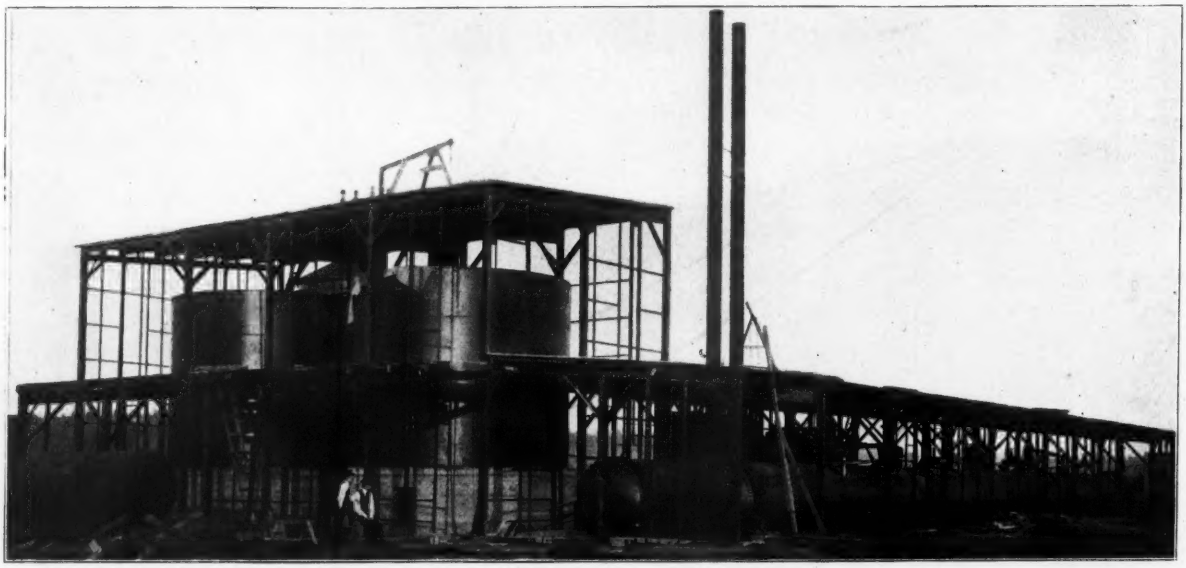


Green Springs Plant Under Construction, Showing Working Tanks and Retorts.

easily and quickly accomplished by admitting atmospheric pressure to the treating cylinder while the pressure tank still maintains a vacuum. This combination of pressure-measuring-drain tank is entirely unique with the plant at Green Spring. It was worked out by the writer, assisted by Card and McArdle, who were the draftsmen in getting out the pipe plans. It eliminated entirely the dirty and expensive pressure pumps commonly in use in timber-treating plants.

Recording gauges and recording thermometers are connected to the treating cylinders. This places the superintendent in complete touch with the treatment in all of its details, the charts indicating the tempertaure, pressure and vacuum for every moment the plant is in operation.

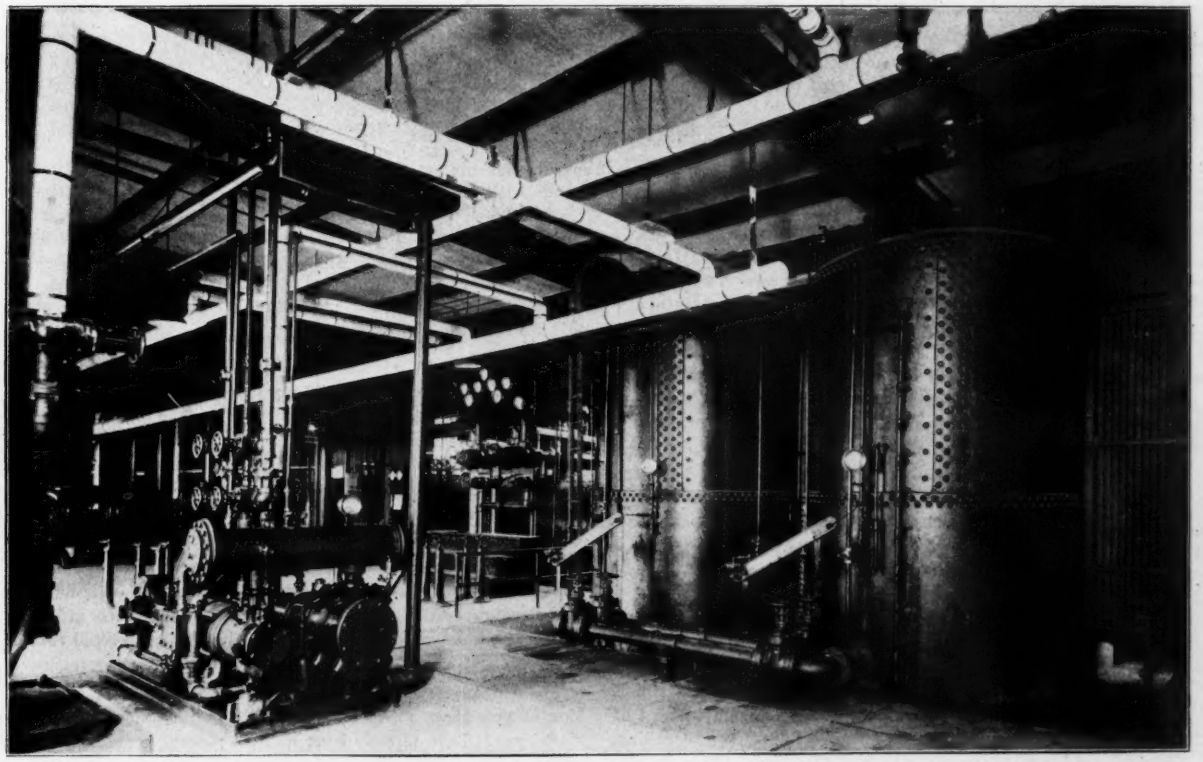
The plant is heated throughout by steam, the vacuum system being used, all condensation being returned to the boiler feed heater and thence to the boilers. A 50-kw. generator furnishes the light for the plant and the yard, there being three arc lamps and about 50 incandescent lamps in the system. The electric plant also furnishes current to operate two 10 H. P. centrifugal pumps and a 1 H. P. bilge pump. The centrifugal pumps are 8-inch ones, used to circulate the mixture of creosote and zinc-chloride in the retorts while using the Card process. The bilge pump is in the settling tank and is used to pump creosote, that may have settled out from the drainings, into the underground unloading tank.

An experimental plant is situated adjacent to the main building. This plant consists of a complete physical and chemical laboratory. The experimental cylinder is 30 ins. in diameter and 9½ ft. long, or large enough to hold three or four ties. There are two working or pressure tanks, underground drain tank, pressure pumps and electric centrifugal pump. The tanks are equipped with the latest gauges and thermometers and the entire plant is so designed that any process can be used and pressure can be supplied as high as 300 pounds. The chemical laboratory adjoins the physical laboratory, and creosote distillations, zinc-chloride analyses, etc., will be made.

Looking Down on Tie Yard From Treating Plant.

Tie Piles and Three-Rail Tracks.

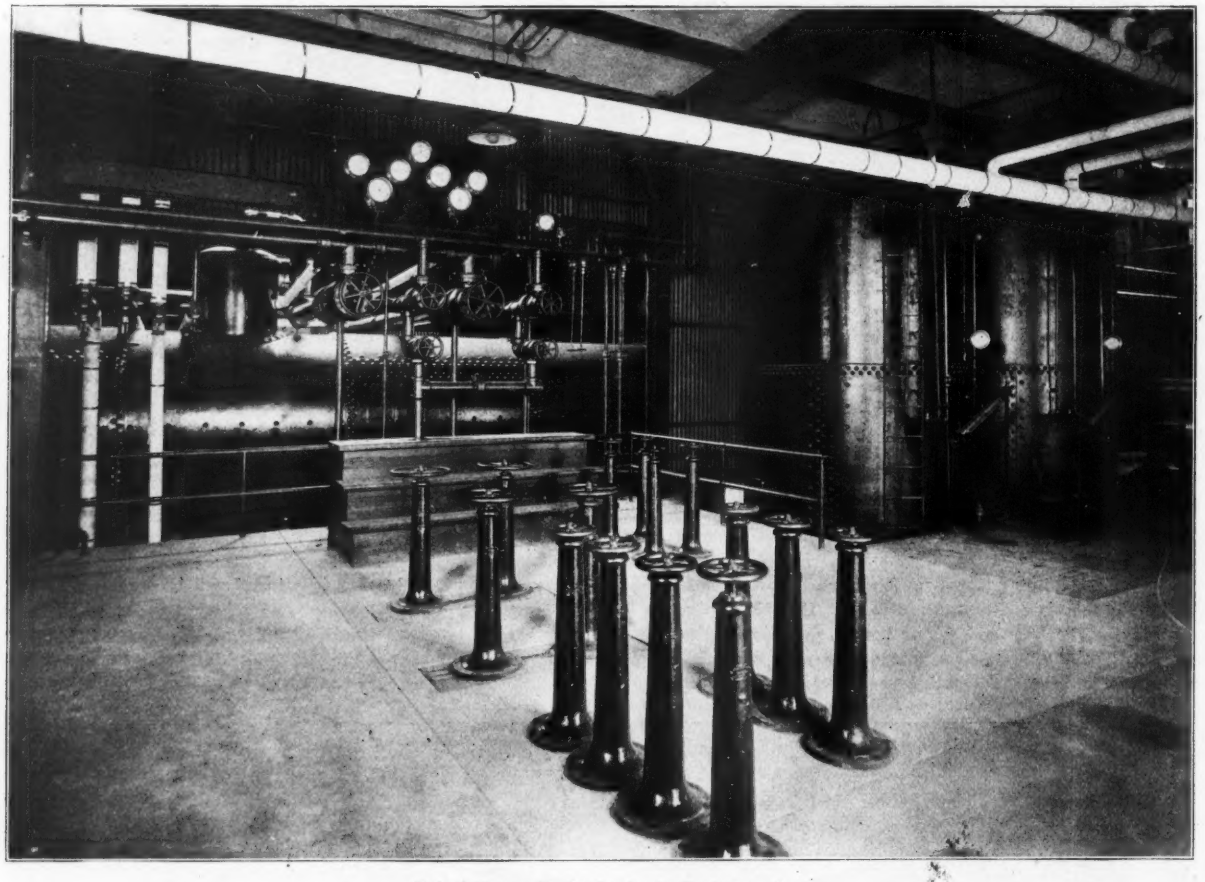
The office building is of concrete and is fireproof in its entire construction. The same is true of the other buildings in the plant. The hose and engine houses are of wood, but these are small and located some distance from the other buildings. A fire system has been installed as a protection against destruction in this way, and a fire department will be organized among the employes, the organization of which will be similar to that at the large terminals, shops and other centers on the Baltimore and Ohio R. R. A 6-in. water main has been laid the entire length of the tie yard, with a hydrant every 300



Combination Pressure, Measuring Drain Tanks, Connected to Clayton Compressor.

ft. The hose house is near the office and is equipped with a reel of 300 feet of hose. Water pressure for fire emergency is maintained by a high 50,000 gallon water tank kept filled at all times.

At the present time the water used in the timber-treating plant is being pumped from the Potomac river, but this arrangement is but temporary until a permanent water system can be built for the joint use of the timber-treating plant, and for supplying water to locomotives in train service. The permanent water plant plan calls for two pumps located at the plant in a concrete well about 100 feet below the surface of the ground. The depression was deemed necessary on account of the lift from the river. Water will be pumped into the high storage tanks and fed by gravity throughout the plant and yard.



Retort Room, Drain Tanks in Background.

Practically all of the ties treated at the plant to date are oak, the number being approximately 200,000. The standard tie in use on the Baltimore and Ohio is 7 by 8 ins. and 8½ ft. long, containing 3⅓ cu. ft. These ties are unloaded and cribbed in piles of seven and one, and are handled by piece work. It is the intention to air-season all ties. However, if they are not received in quantities sufficient to properly air-season, the plant is designed to take care of this by giving a preliminary steaming and vacuum before the injection of preservatives.

All storage yard tracks have three rails, the outside pair being of standard gauge and the inside rail fixing a 30-in. gauge for the tram cars. In loading for treatment the ties are classified as hard and soft woods and as No. 1 and No. 2. For this work the men are paid at a rate per tram instead of per tie as is the case of unloading and cribbing for seasoning. Thus it makes no difference whether there are 30 or 40 ties on a tram, the cubical contents are practically the same and the amount paid is the same. There are 130 tie cars used to deliver the ties to and from the treating cylinders.

The location of the timber-treating plant is believed to be admirably suited for all purposes, being in close proximity to large timber areas. Green Spring is at the junction of the Romney Branch with the main line of the Baltimore and Ohio R. R. The Romney Branch, which extends 16 miles to Romney, W. Va., and the Hampshire Southern R. R., extending 38 miles farther to Petersburg, tap a timber tract of several thousand acres, much of it being virgin timber. The outlet for all timber adjacent to the lines mentioned is by way of Green Spring. It is in reality merely a question of stopping the timber at the plant to have it seasoned and treated.

The Canadian Pacific is building, in connection with the grade separation work at North Toronto, a 5 track viaduct about 3½ miles long, including new terminals, etc. At present 5 subways are under construction by contract, and 5 additional subways will probably be under construction soon, also the erection of the new union station at Yonge street. The work is being carried out jointly for the Canadian Pacific and the Canadian Northern.

The Chesapeake & Ohio has awarded a contract to Langhorne & Langhorne of Huntington, W. Va., to construct a bridge across Big Sandy river at Wallbridge, Ky., at a reported cost of $200,000.

The Chicago & Alton has appropriated $987,000 for the erection of new shops at Bloomington, Ill. A roundhouse and additional yards have already been built, a passenger station is now under construction, and additional yard tracks are contemplated.

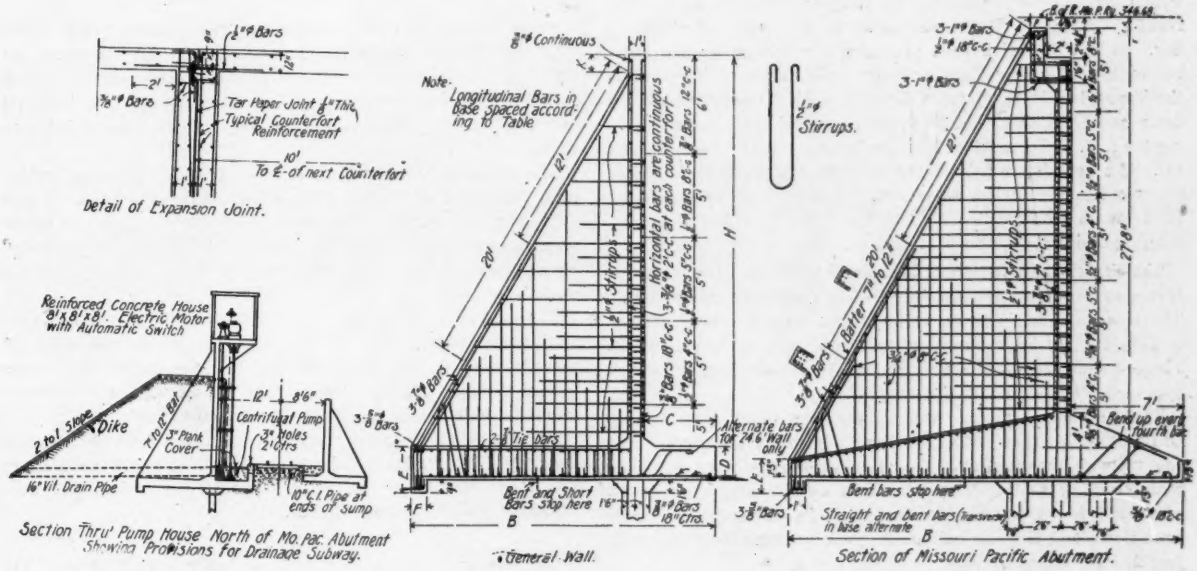
DESIGN OF A CONCRETE RETAINING WALL WITH FOUNDATIONS ON PERMEABLE SOIL.

By E. E. Howard.*

After several disastrous floods in the Valley of the Kaw River, a State Drainage Board was formed, and proceeded with the construction of levees alongside the river and with the widening and cleaning of the channel. This made necessary the revising and re-locating of many tracks adjacent to and crossing the river at Kansas City, Mo., including the raising some 8 ft. of the Union Pacific & Missouri Pacific tracks, which crossed overhead of the Kansas City Southern Belt Line. This in turn required a change in elevation of the Belt Line track alongside the river, the alignment of which had already been somewhat altered by reason of levee locations.

The space available was restricted and the track in general occupied about the space of one-half of the levee proper, as originally laid out, so that the usual levee about 30 ft. wide on top, with slopes of two to one on each side, was replaced by a vertical wall on one side and an earth fill on the river side, some 6 ft. wide on top, with a two to one slope toward the river. The wall thus formed a part of the levee. The entire river bank is of deposited material, principally of sand, deposited in part by the river, and in part pumped into place. Thus the walls had to be built on a foundation of permeable material, through which the water might permeate and produce an up-lift under the bottom of the wall by saturation of the material. The levee fill itself, under the construction of the drainage district, consisted merely of the sand and soil of the river bank, scraped into place without rolling or tamping, but faced with a concrete slab on the river side of the slope, about 4 ins. thick. There was thus the probability that the levee itself would be permeated with water, and that there would be a pressure of saturated material against the wall. Because of the concrete facing, however, it is probable that the seepage would be slow. The occasion of a sudden cutting or a great wash would be remote. In order to reduce the weight as much as possible the wall was designed as economically in amount of concrete as seemed proper.

The wall is designed to support material, which, when saturated, would weigh 125 lb. per cu. ft. The up-lift on the bottom of the wall was assumed to be at the heel of the base, 80 per cent of the hydrostatic pressure. It was assumed that at the toe of the wall, which is only slightly below the grade of the track, this up-lift pressure would be reduced to zero, as the material above the toe would offer but slight resistance to free flowing of the water. The up-lift on the base, therefore, was assumed to vary from zero at the toe to 80 per cent of the hydrostatic at the heel. The foundation material is loaded to a maximum intensity of one ton per square foot for the extreme load at the toe. Where this pressure is exceeded, piles loaded to 36 tons each are placed under the front wall at intervals which will reduce the pressure on the soil to one ton per square foot. As the lower portion of this wall is considerably above low water level of the river, concrete piles were at first considered necessary. In the removal of the old pile trestle, however, it was found that the piles, except immediately at the ground line, were thoroughly sound and in good condition, many of them having been in place for about 18 years. After careful examination of a large number of the piles so removed, it was decided to use timber piles under the wall, as the evidence seemed conclusive that there would be sufficient ground water to seal the piles and preserve them indefinitely.


Detail of Expansion Joint.
Tar Paper Joint
Typical Counterfort Reinforcement
To E. of next Counterfort
Section Thru' Pump House North of Mo. Pac. Abutment Showing Provisions for Drainage Subway.
Reinforced Concrete House 8'x8'x8'. Electric Motor with Automatic Switch
Dike
Centrifugal Pump
Plank Cover
Vit. Drain Pipe
C.I. Pipe at ends of sump
Note- Longitudinal Bars in Base Spaced according to Table
Stirrups.
Horizontal bars are continuous
Tie Bars
Bent and Short Bars Stop here
General Wall.
Alternate bars for 24'6" wall only
Bent bars stop here
Straight and bent bars (transverse) in base alternate
Section of Missouri Pacific Abutment.

Standard Expansion Joint. Reinforced Concrete Wall.

Typical Wall Section.

Modification of Wall Section at Abutment.

*Associate Engineer, Waddell & Harrington, Consulting Engineers.

The Chicago & North Western will start work at once on its new shops at Clinton, Ia. The American Bridge Co. will fabricate the steel.

The Chicago, Rock Island & Pacific will erect a new freight house at Keokuk, Ia., at an estimated expenditure of $45,000.

Application is being made to the Canadian parliament to vest in the Van Buren Bridge Co. the charter rights of the International Railway of New Brunswick, to build a bridge over the St. John river, between St. Leonards, New Brunswick and Van Buren, Maine.

The Grand Trunk is reported to be making extensive improvements at Bay City, Mich., which include a bridge across the Saginaw river, a new passenger station and a freight house, at an estimated total cost of $750,000.

The Grand Trunk Pacific has let a contract for $2,000,000 to cover the cost of building 12 bridges between the two heads of steel on the western main line. The longest bridge will be 1,227 feet and will be across the Frazer river.

Three Level Crossing at 75th Street, Chicago

Grand Crossing derived its name from the fact that there was originally a grade crossing at that place of the Illinois Central R. R., the New York, Chicago & St. Louis R. R., the Pennsylvania Lines West, and the Lake Shore & Michigan Southern Ry. The first crossing was put in in 1852; at that time the location was far in the country but at present the crossing is well within the city limits of Chicago.

A difficult project was completed when the last permanent structures were finished. The four steam railways and one street railway were involved in this work—a three level crossing. The object was to eliminate both street and railway grade crossings. About 600 trains daily are operated over the crossing.

The Pennsylvania Lines run northeast by southwest at the crossing, being on tangent the entire distance—a 4-track line, with provision for increasing the number of tracks to 7. The Illinois Central R. R. crosses under at an angle of about 45 deg. It has 8 tracks, with provision for increasing the number to 15. The New York, Chicago & St. Louis R. R. parallels the Pennsylvania Lines for a distance with 2 tracks, which dip down and cross under the Pennsylvania tracks just before reaching the I. C. R. R., a future increase to four tracks being provided for. The Lake Shore & Michigan Southern Ry. parallels the Pennsylvania Lines, and has at present 4 tracks, with provision for an increase to seven. The Chicago City Rys. has 2 tracks, running due east and west in 75th st.

The city ordinance requires bridges of either one, two, three or four spans, over the streets, provided with suitable waterproofing. The clearance on 75th St. and Chicago Ave. for low bridges, is 13½ ft. On 76th St. the clearance on low bridges is 12 ft. The ordinance required a width of 65 ft. in subways, the street approaches to be on 3 or 3½ ft. grades.

The previous crossing was at grade without interlocking. Ordinary gates that swung by hand controlled the traffic over the railway crossing and the street crossings were provided with crossing gates. The total cost of the separation work amounted to $4,000,000, but the great improvement in traffic conditions, and the elimination of grade crossing dangers, amply justified the expenditure.

The figure mentioned above refers to total cost of present construction in the limits of the grade separation work. The costs were distributed as follows:

Pennsylvania Lines	$1,160,000
Illinois Central R. R.	1,080,000
New York, Chicago & St. Louis R. R.	500,000
Lake Shore & Michigan Southern Ry.	1,260,000

The division of costs was effected by arbitration.

The general method used in construction was first, to raise all tracks at the crossing on earth embankment—putting the tracks at the I. C. R. R. permanent grade, in a series of lifts aggregating seven feet. The overhead tracks were then put up on false work, over the I. C. C. R. R., one at a time, the approaches being carried up on earth embankment without false work, except those of the first track raised.

Pennsylvania R. R.

The old Pennsylvania grade was level and the alignment was tangent. The Pennsylvania tracks are at the highest or third level, being 26 ft. above the old grade line. The approach is on 0.3% grades. No change was made in the alignment.

There is one Y-track connecting the Pennsylvania Lines with the Illinois Central R. R. The degree of curvature on this "Y" is 16, and the grade is 0.7% compensated. Each railway paid for constructing that part of the "Y" on its own right-of-way, the remainder being divided equally between them.

The Pennsylvania tracks over the I. C. R. R. were raised on a falsework of timber piles, driven between tracks. Where necessary the tracks below were lined out to give the necessary clearance at each of the bents. The filling was unloaded on the approaches, from gondolas, by hand, and distributed with a spreader.

The northerly trestle was built first, and filling was unloaded and spread toward the South. A second track was built on the fill when it was high enough, and the trestle track was turned over to regular traffic. The filling was then resumed from the new track, continuing toward the South.

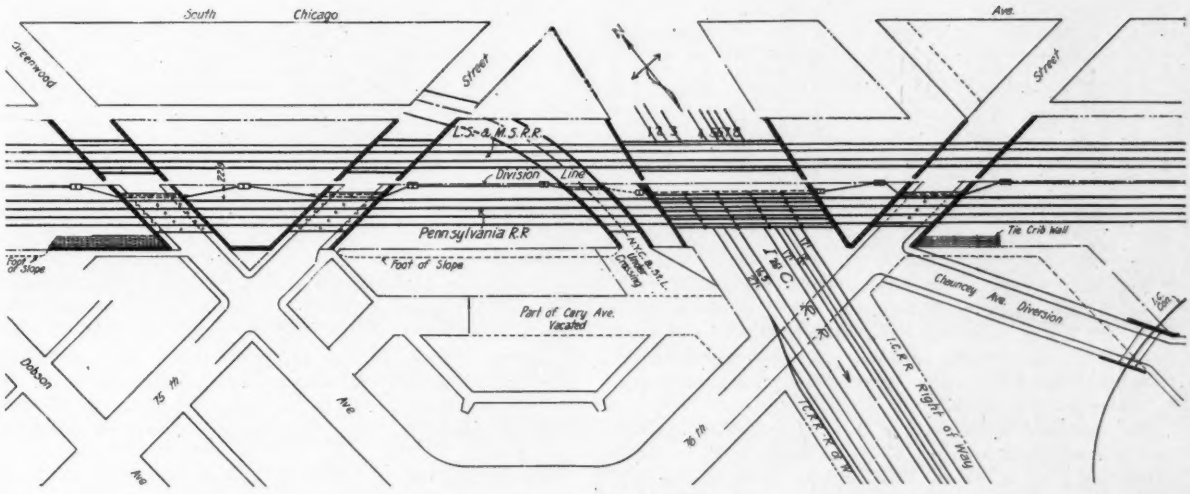
Practically all the false work was recovered from the crossing over the I. C. R. R., but back on the embankment no attempt was made to recover the piles. The stringers, however, were recovered without undue expense.

Structures.

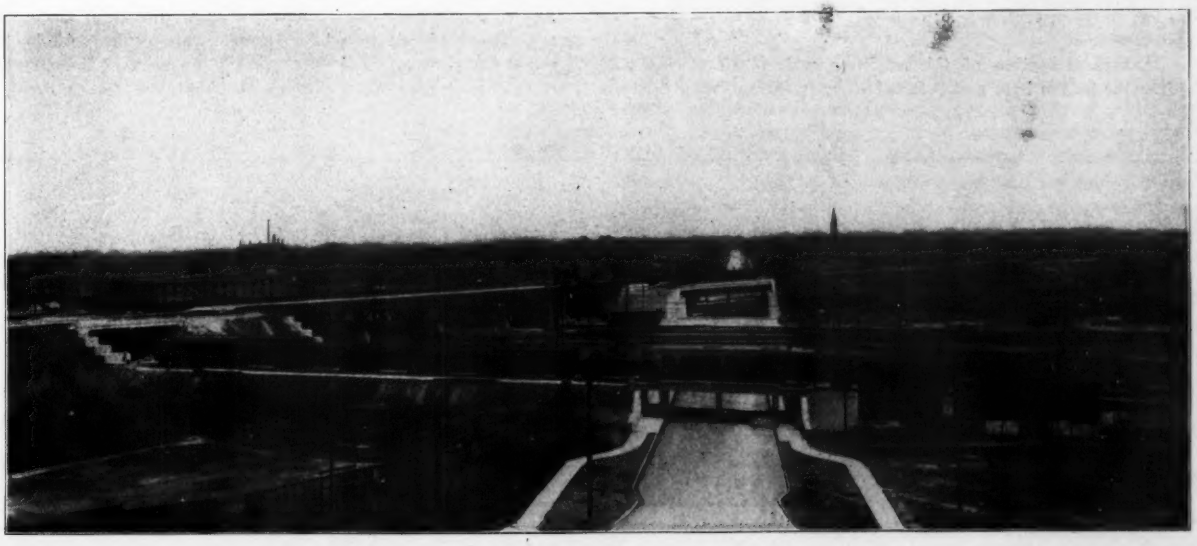
The clearance above the I. C. R. R. track is 17 ft. 0 ins. The structure is a half through plate girder, located at an angle of 44 deg. 34 min. with the I. C. tracks. The abutments were excavated in open trenches, but the piers excavations were sunk by caissons. The materials encountered were sand, clay, and then hard pan, on which the foundations rest.

General View, 75th St., Three-Level Crossing.

View of Grand Crossing Before Grade Separation.



New Track Layout, Grand Crossing.



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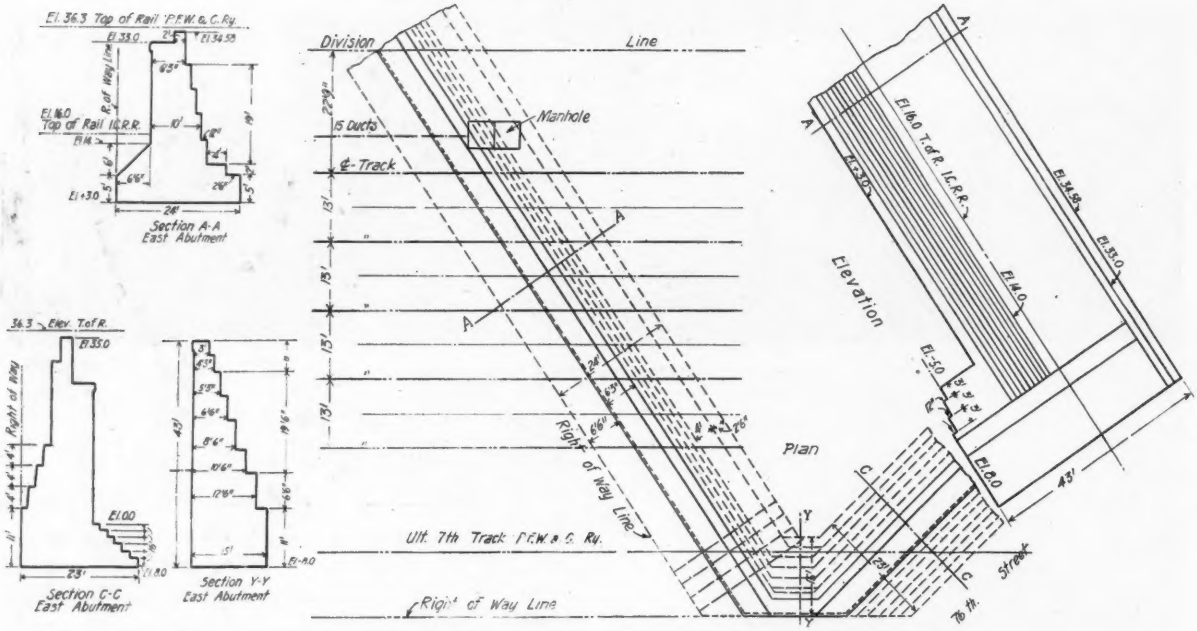


Plans and Section of East Abutment, Pennsylvania Bridge, Over I. C. R. R.

The piers are located on a skew 15 ft. 8⅝ in. centers transversely, and the spans are 42 and 43 ft. Piers are 4 ft. 6 ins. in diameter, with a coping 5 ft. in diameter, and support columns of heavy section. A typical caisson is 40 ft. high, of plain concrete. The base is spread to a diameter of 11 ft., the footing ring being 2 ft. thick. The section slopes up to the 4 ft. 6 in. diameter in 4 ft. 6 in., the section being uniform above this point to the coping. The capstone is granite 3 ft. square and 2 ft. thick.

The abutments are also on a skew. The east abutment, a plan and section of which is shown herewith, is 30 ft. high to bridge seat, has a 29 ft. base, with a 6 ft. sloping offset below ground at the front, and 6 horizontal offsets on the back, width under coping being 6 ft. 3 in. The front of the footing is on the right-of-way line, and the face of abutment is 6 ft. 6 in. back of same.

The east abutment connects with retaining walls on both sides. The excavation for abutments and piers was: Dry earth, 1,646 cu. yds.; cost, $1,646; concrete yardage was 3,840 cu. yds.; cost, $23,040.

A typical section of the retaining wall is 43 ft. high, 15 ft. wide at the base and 3 ft. wide under coping, with 7 offsets varying from 1 ft. to 3 ft. The face is vertical, and the steps are horizontal with vertical backs.

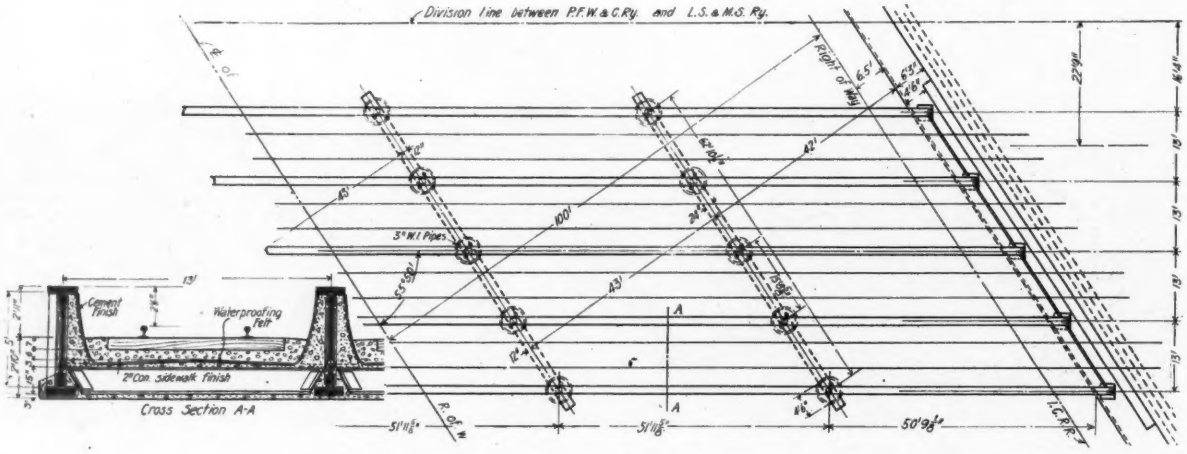
The west abutment is 30 ft. high to bridge seat. It has symmetrical offsets on each side below ground, the width at bottom being 19 ft., and from top of last offset to under coping, 6 ft.

The structure at the crossing has a ballasted deck longitudinal trough floor, supported by through plate girders. The spans nest to each abutment are 42 ft. each, the rest being 43 ft. Five columns support the track at piers, each resting on a concrete cylinder.

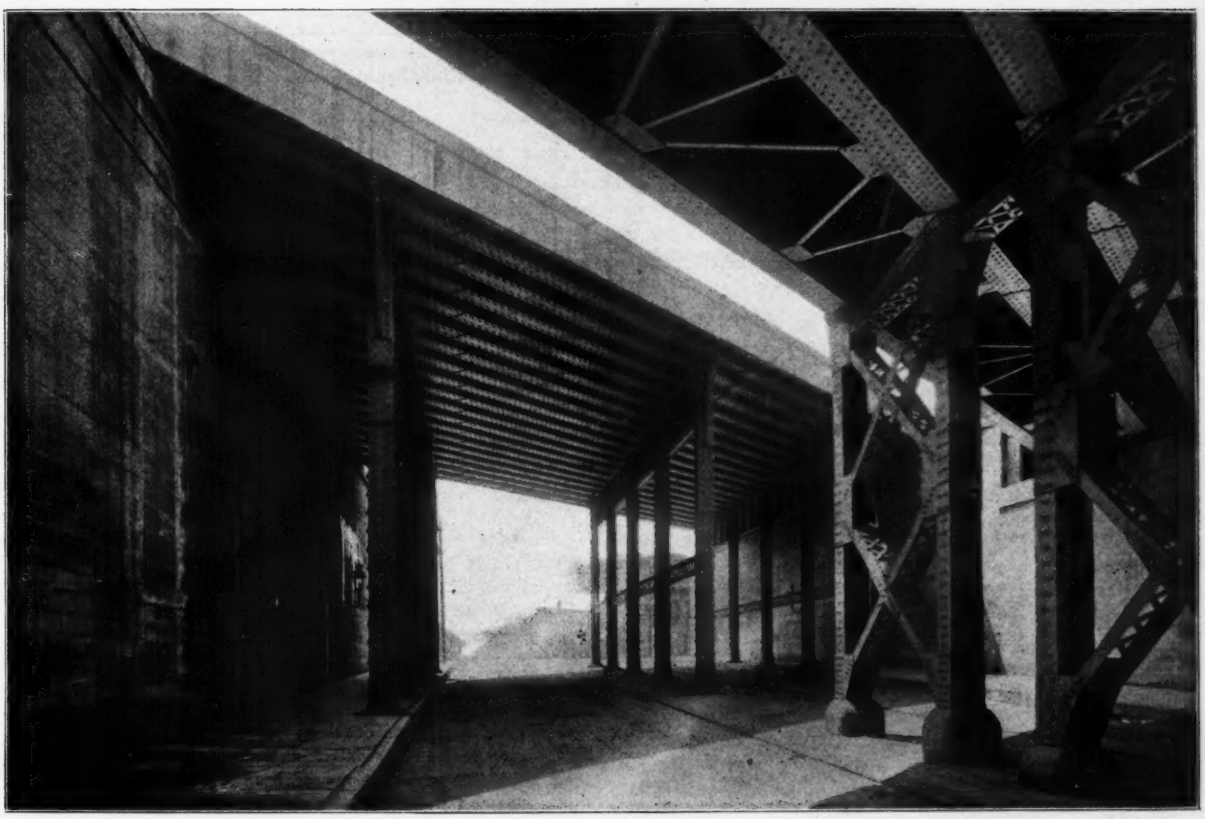
The bridge floor is encased in concrete of varying thickness, the top of which is given a concrete sidewalk finish, and covered with 5-ply waterproofing felt and compound. The concrete is carried up to upper flange of the built-up girder, the lower flange being completely encased.

The viaduct at Seventy-fifth street is at an angle of 44° 34′ with the street. There are three rows of columns, one at the outer edge of each sidewalk and one in the center of the roadway. This structure is a half through plate girder with longitudinal trough floor. The outer girders are encased in concrete.

C-C is a section taken through the abutment for the bridge



Floor Plan and Details, Pennsylvania Bridge, Over I. C. R. R.



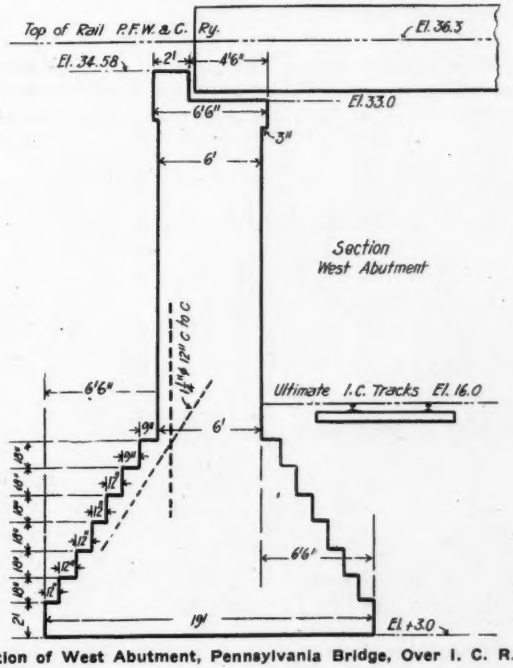
Pennsylvania 75th St. Viaduct, Trough Floor, Fascia Girder Encased in Concrete.

crossing Seventy-fifth street. The section shows the offsets on both front and back, a feature of all the sections being vertical and horizontal lines in both face and back of abutments. Concrete for the abutments was a 1:3:6 mixture.

The excavations for abutments and piers were made in open trenches, sand and hard blue clay being encountered. The abutments are 30.26 ft. from top of footing to bridge seat; they have stepped backs and vertical fronts.

The longest columns in this structure are about 27 ft. long, the viaduct being an excessively high one compared with others over street crossings. The columns are of heavy section and well braced. They rest on square footings, offset in four steps, from 3 ft. square at the top to 9 ft. at the bottom.

The concrete used was a 1:3:6 mixture. The bridge is waterproofed with 5-ply felt and compound. The roadway pavement is brick, and the sidewalks are concrete. The steel was erected by derricks located on temporary trestle tracks.



Section of West Abutment, Pennsylvania Bridge, Over I. C. R. R.

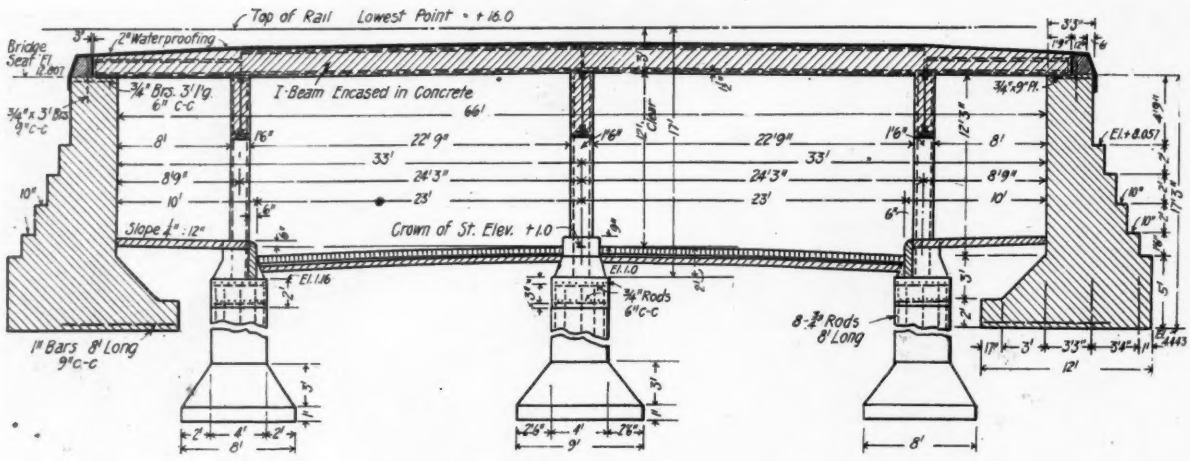
Street Depression.

The Seventy-fifth street roadway was depressed 6 or 7 ft. at the crossing under the I. C. R. R.; the approach is on a 3.0% grade, necessitating some excavating under and adjacent to the Pennsylvania's Seventy-fifth street viaduct. The excavation was made by dump wagons and scrapers and the material was placed in the fill for tracks. At Seventy-fifth street the excavation was 1,650 cu. yds., and at Seventy-sixth street it amounted to 1,900 cu. yds., Pennsylvania work only. The original street was 66 ft. wide, but the width was increased to 80 ft. during this work.

The Seventy-fifth street car line was closed for a time, and passengers were required to walk from one side of the work to the opposite side.

Illinois Central R. R.

The tracks of the Illinois Central R. R. were raised about 7 ft. at the crossing, which, with some excavation in the streets, gave the required clearance under the I. C. structures. The old grade was level; the new approaches are on a 0.45% grade. A rearrangement of alignment was necessary on account of the supports for the P. R. R. and L. S. & M. S. Ry. bridge between tracks; these requiring a 7½ ft. clearance from center line of track.



Cross Section I. C. R. R. Encased Concrete Subway at 76th St.

In addition to the Y-track connecting with the Pennsylvania R. R., there is also a Y connection with the L. S. & M. S. Ry., the latter being entirely constructed by the I. C. R. R. on its own right-of-way.

Construction.

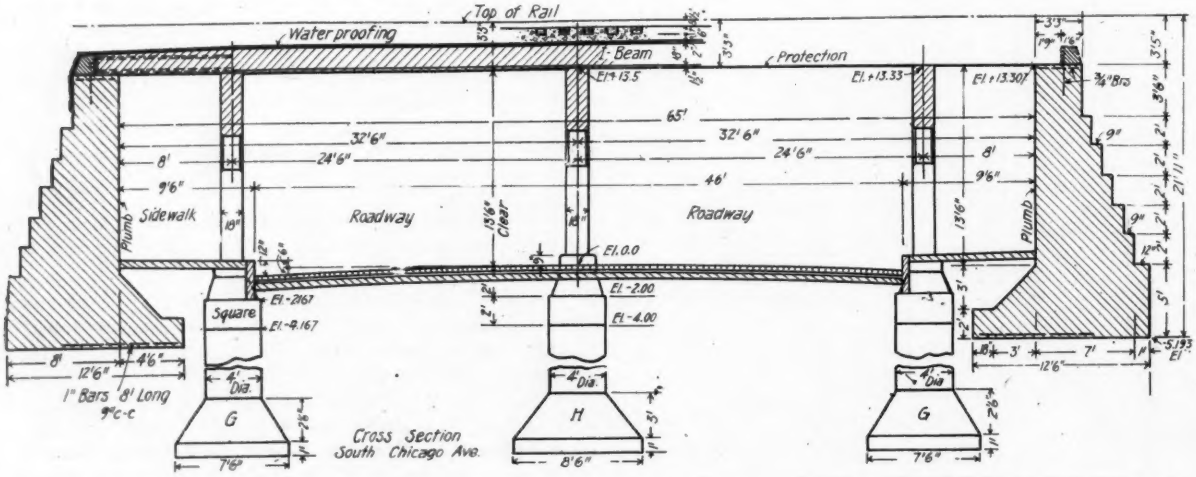
The construction work on the Illinois Central R. R. was simpler than on the other railways, as only a 7 ft. raise was necessary, and there were no traffic lines beneath which had to be kept open. On the other hand, the excavations in the streets were much greater on this road, involving many difficulties in taking care of underground facilities of public service corporations. The streets at Seventy-fifth and South Chicago avenue intersection had 5 gas mains, 2 water mains, 4 electric power conduits, 2 telegraph conduits and 2 sewers. With conduits of this kind, especially gas and water mains, etc., which must be kept in service, work becomes very congested and complicated. During construction these lines were supported on blocking, or on earth embankments, until the street had been excavated when they were lowered by gradually digging out the earth support or taking out the blocking. When lowering gas or water mains it is usually required that a force of the company owning the mains be on hand to repair leaks or to do the entire work of lowering. The grade of the street was lowered below existing sewers, and a 3,100 ft. line of permanent 24 in. sewer was laid to a large intercepting sewer at Seventy-ninth street, to properly drain the subways. In raising the tracks above streets the usual procedure was about as follows: 5-pile bents were placed to clear the permanent work, and driven nearly to the ground surface. They were then cut off and capped. The track was raised between streets and sloped off towards the street. The deck of the bridge was then raised with jacks and another cap placed on top of the old one, and the process repeated. This method, of course, closes the street to traffic, but is of advantage in getting the first track up. Adjacent tracks were then usually raised in the same way, or by building falsework and decking it at the proper elevation of the finished grade. In the latter method the street can be kept open for traffic while the approaches are being raised to grade.

An interesting feature of this work was the raising of the west three tracks in Fordham yard, necessitated by change in main line elevation. These tracks were raised by a derrick car, giving about an 18 in. lift. The derrick was provided with clamps which were attached to the rails, the track raised, and ties tamped by laborers.

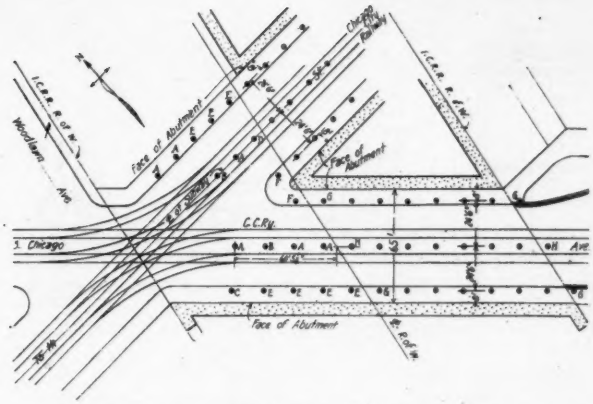
During construction work the trains from Fordham yard, the company's freight terminal, were shunted off on two tracks at Seventy-sixth street, which were extended for that purpose to the yard at Eighty-second street, thus freeing the tracks from Seventy-sixth to Eightieth streets from freight transfer movements.

Structures.

Chicago avenue and Seventy-fifth street were cut down 9 ft. The excavation amounted to about 40,000 cu. yds. The method of excavating was by hand into small cars hauled by mules.



Cross Section, South Chicago Ave. Subway, I. C. R. R. Comparison With Section Above Shows That This Is a Typical Street Viaduct Type.



Layout of Columns and Street Car Tracks at 75th St. and Chicago Ave.

The bodies of the loaded cars were lifted by a fixed derrick and the dirt dumped into gondolas and used for widening the embankment at Eighty-second street.

The streets were closed, and street car traffic was abandoned during excavation.

The loading for which bridges were designed was practically E 55, with impact of $\frac{LL}{LL + DL}$

The abutments and piers for the subways at Seventy-fifth street and Chicago avenue rest on blue clay. Abutments are of 1:3:6 mixture, and piers are of 1:2:4 mixture. The abutments are 12 ft. 6 in. broad at the base, with a toe projection of 4 ft. 6 in., reinforced by 1 in. bars, 8 ft. long, spaced on 9 in. centers. The toe is 2 ft. thick, sloping up to main body of pier, as shown in the section. The face is plumb, and the back has 6 steps with vertical and horizontal faces.

There are three rows of piers, one at the edge of each sidewalk and one in the center of the roadway. The transverse spacing is 16 ft. 7⅝ in.; the longitudinal span is 8 ft. to edge of sidewalk, and 24 ft. 6 in. to center of roadway. The skew, however, makes the long span 39 ft. 3⅜ in.

The piers are reinforced at the tops, several sections being used according to the length of span supported. The diameter of the body of piers is 4 ft.; the tops are square, of varying widths, and the bases are round, varying from 7 ft. to 10 ft. in diameter. The column sections and their locations under the structure are shown in the diagram. The plan also explains the reason for the difference in diameter of the floor columns in the different parts, the span varying from 24 ft. 10⅞ in. to 77 ft. 8⅞ in. The caissons are reinforced only at top, as shown.. It is evident that this reinforcement is to distribute excessive stresses which are liable to be caused by the deflection of the beam concentrating the load at edge of pier.

Where the structure spans but one street the caissons are made with only two sizes of footing—7 ft. 6 in. in diameter for sidewalk caissons, and 8 ft. 6 in. for center of roadway caissons. The spans on Chicago avenue are 9 ft. 6 in. to edge of sidewalk and 29 ft. 7⅜ in. to center of roadway, on a skew of 55 deg., 49 min. and 25 sec.

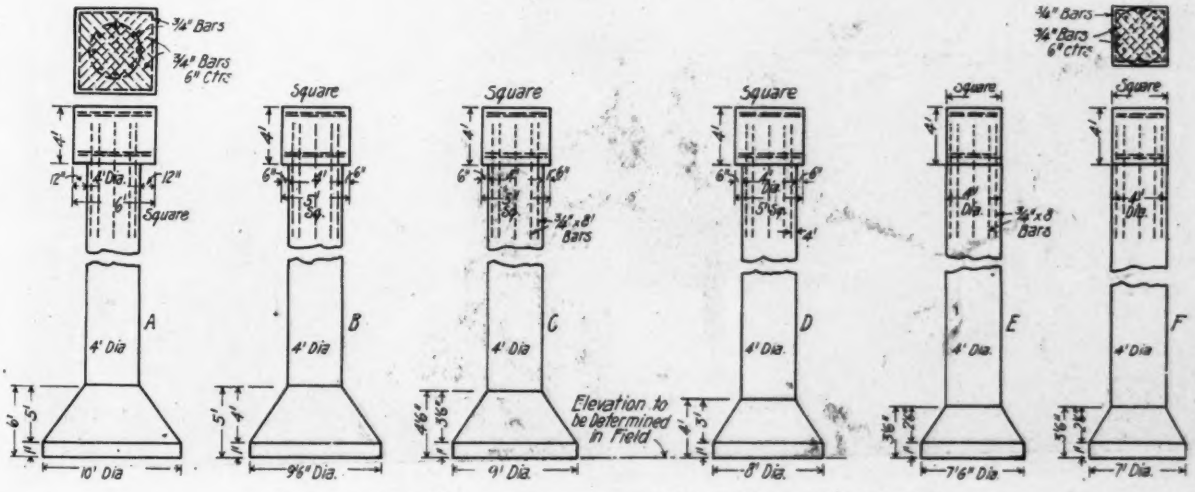
The floor on the west side of the center line of bridge is of longitudinal I-beams. For the long span these are 28 in., 80 lb. beams, spaced at about 1 ft. 2 in. The short spans between edge of sidewalk and abutment are floored with 12 in., 31½ lb. I-beams, spaced at about 1 ft. 6 in. or 7 in. These beams are parallel with bridge line.

On the west side of the bridge some heavy through girders were required to carry the long spans at the intersection of Chicago avenue and Seventy-fifth street. The floor in this section is of encased 12 in. I-beams on about 1 ft. 2 in. centers. The I-beams, however, are at right angles to the center line of bridge, carrying their load to the girders, and not directly to column beams as on opposite side of the bridge. Through-girders were used to make the clearance of the bridge a maximum without excessive excavation. The concrete casing is carried up over the girders. The floor is waterproofed with five layers of felt and one of burlap, mopped with hot pitch.

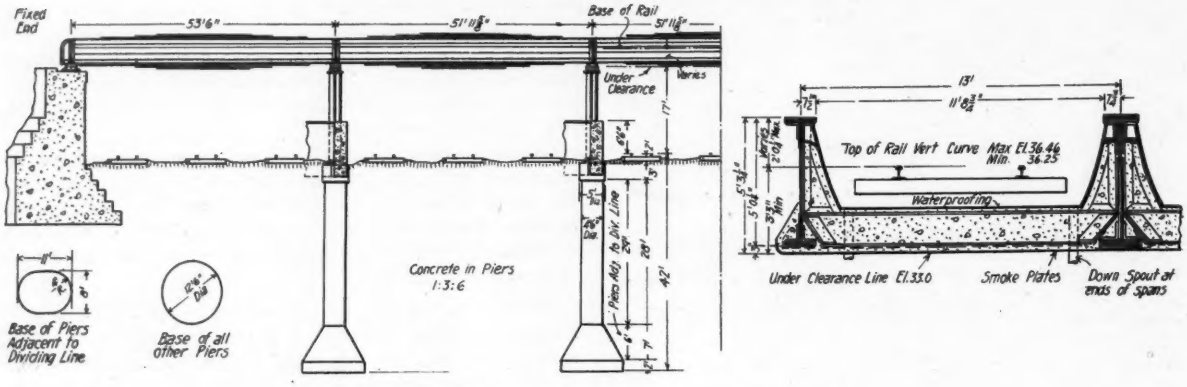
The original width of these streets was 80 and 100 ft., the final width in subway being 65 ft. The roadway pavements are brick, and sidewalks are concrete. Sidewalks are protected by an iron railing, where curb is 18 in. or more above crown of pavement.

The structure at Seventy-sixth street is an encased structural steel viaduct. It has an I-beam floor, I-beams parallel to track center line. The floor beams rest on girders supported by columns and piers, the girders being designed in two weights. The heaviest weight girder is on a row of columns in the center of roadway, span 24 ft. 3 in. The span from center of beam at edge of sidewalk to abutment is 8 ft. 9 in.

The girder for the long span is made up of 4 angles 6x6x⅝ in., web plate 48x$\frac{13}{16}$ in., and 2 flange plates, one on top and one on bottom, 9 ft. x 14 in. x ⅜ in. The column is made up of two 15 in., 33 lb. channels, four 6x3½x⅜ in. angles, and one 12½x⅝ in. plate.



Details of Caissons A, B, C, D, E and F, 75th St. and Chicago Ave., I. C. R. R.



L. S. & M. S. Ry. Bridge Over I. C. R. R., Grand Crossing, Ill.

The entire structure is encased—the fascia girders, columns, column girders and I-beam floor. Construction joints are provided above each column in concrete girder casings. The concrete encasing 20 in. I-beams (used across long spans) is 1 ft. 9 in. thick. Concrete on 15 in. I-beam floor is 1 ft. 6 in. thick. The I-beams across the sidewalk spans are 12 in., 31½ lbs.

The columns are spaced transversely on 14 ft. 1½ in. centers. The foundation piers are similar to those used in the Chicago avenue and Seventy-fifth street viaducts. The footings of the piers on sidewalk line are 8 ft. in diameter, the footings on center of roadway piers being 9 ft. in diameter.

The abutments have front and rear projection. The front projects 4 ft. 5 in. beyond face of abutment, this projection being reinforced by 1 in. bars, 8 ft. long, spaced on 9 in. centers, extending about 5 ft. back beyond abutment face.

The waterproofing is similar to that on the other viaducts —five layers of felt and one of burlap, each layer mopped with hot pitch as laid. The waterproofing is 2 in. thick on a smooth cement top finish.

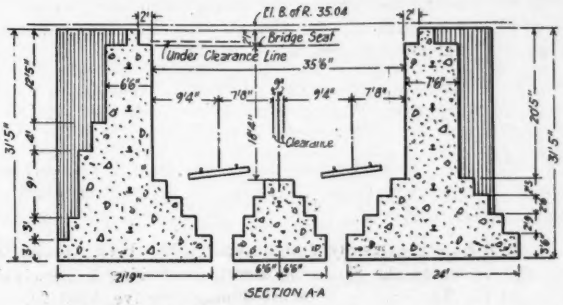
Lake Shore & Michigan Southern Ry.

The structure of the Lake Shore & Michigan Southern Ry. over the I. C. R. R. is a through plate girder bridge with 15 in. transverse I-beam floor, having a length of 213 ft. face to face of abutments, divided into two 42 ft. and two 43 ft. spans.

The abutment foundations are at an elevation of + 3, the pier foundations being at — 26. The abutments are stepped back on front from a broad base, all steps being below the elevation of the I. C. R. R. roadbed. The back of the abutment is stepped at a considerable higher elevation. This type of wall, which is similar to the Pennsylvania's at this point, gives a maximum toe extension with maximum offsets to face, resulting in a minimum weight in the toe extension. This makes the center of gravity much nearer the back than the front of the wall; the design distributes and equalizes the foundation pressures in an admirable manner.

The caissons supporting the columns are carried down to bed rock. The bases of these have 12 ft. 6 in. diameters, with the exception of the outer ones. The latter are of rectangular center

L. S. & M. S. Ry. Deck Plate Girder Viaduct, 75th St.



Cross Section, L. S. & M. S. Ry. Bridge Over Nickel Plate Road.

section, and are 11 ft. long, with ends rounded on a 4 ft. radius. The thickness of footing ring is 2 ft. The offset is on an angle running back 4 ft. in 6, the diameter of the body of pier being 4 ft. 6 in. The cap stone is 3 ft. thick with a diameter of 5 ft.

The two exterior columns on each side of bridge are cross braced with double diagonal bracing; center columns are not cross braced.

The New York, Chicago & St. Louis Ry. passes under both the Pennsylvania and the Lake Shore, as shown on the general plan of track layout.

The structure is on a 10 deg. curve. It has two spans, a row of columns being located between the two tracks of the N. C. & St. L. Ry. The floor is of 18 in. I-beams perpendicular to center line of bridge. These I-beams are encased in concrete, waterproofed, and support the track ballast.

The column consists of a 12 in. I-beam encased in a square concrete section. Horizontal reinforcing squares were placed in the column; they are ¼ in. square corrugated bars 5 ft. long, bent into squares with a lap of about 3 ins. These were dropped down over the ends of the I-beam after it was placed, and spaced on 9 in. centers. Two vertical ¼ in. bars, 10 ft. long, were inserted just inside the horizontal squares, between the flanges of the I-beam.

The base of the I-beam has a broad base-plate riveted to two vertical cover plates, which in turn are riveted to flanges of I-beam. The base is 3 ft. sq. and 9 in. thick. The column is 1 ft. 6 ins. square.

The abutments are 24 ft. and 21 ft. 9 ins. broad at base, leaving only 3 ft. between them and the pier footing, which is 13 ft. wide. The diagram reproduced herewith shows this arrangement, and the old rails embedded laterally in the concrete. The section A-A shows the left hand abutment outside of the outer track, while the right hand abutment is nearer the center line of bridge.

The work on the Pennsylvania R. R. was done under supervision of J. T. Richards, chief engineer maintenance of way, and Robert Trimble, chief engineer maintenance of way, Lines West; to the latter we are indebted for information, plans and photographs used herein. The Illinois Central R. R. work was under the supervision of A. S. Baldwin, chief engineer; D. J. Brumley, engineer of construction, and Maro Johnson, bridge engineer, to whom we are indebted for data and illustrations. The work on the Lake Shore & Michigan Southern Ry. was under the supervision of L. S. Rockwell, chief engineer, and the work on the New York, Chicago & St. Louis Ry. was under the supervision of E. E. Hart, chief engineer.

The Gulf, Colorado & Santa Fe is making improvements at Cleburne, Tex., totaling approximately $175,000. This expenditure includes a wood-working shop, 76x352 ft., $45,000; machinery, $28,000; 3 rip track car sheds, $25,200; a brick dry kiln, $10,200; a frame wheel shop, $6,400, and 3 transfer tables costing $5,200. A frame lumber shed is to be built costing $3,500, automatic yard signals installed costing $2,600, and a number of track additions and rearrangements made.

The Pere Marquette is reported to be planning an expenditure of $200,000 for a round house, repair shop and additional tracks at Chesterton, Ind.

The Philadelphia & Reading, it is said, has awarded a contract to the Phoenix Bridge Co. for 1,500 tons of structural steel for its St. Clair, Pa., shops.

L. S. & M. S. Ry. Encased Bridge Over Nickel Plate Road.

Personals

Operating.

D. Sullivan, formerly superintendent of the Missouri, Kansas & Texas Ry., has been appointed general superintendent of the Appalachicola Northern Ry. office at Port Ste. Joe, Fla. He entered the service of the Missouri Pacific Ry. as messenger boy, and was employed from 1880 to 1890 as operator, dispatcher, and chief dispatcher. He was appointed trainmaster of the Missouri, Kansas & Texas Ry. in 1890, and superintendent in 1897. In 1901 he was appointed trainmaster of the El Paso Northwestern System, and later was made superintendent of transportation, and general superintendent. In 1905 he was elected president and general manager of the Ohio River & Columbus Ry. In May, 1909, he was appointed trainmaster of the Missouri Pacific Ry., and in May, 1911, he entered the service of the Cincinnati, Hamilton & Dayton Ry. as trainmaster and special representative of the operating department. He returned to the Missouri Pacific Ry. as trainmaster in special service in October, 1911, which position he held till April 25, 1913, when he was appointed general superintendent of the Appalachicola Northern as noted above.

M. H. Cahill has been appointed assistant superintendent of the Baltimore & Ohio R. R., at Keyser, W. Va. J. F. Keegan, superintendent, has been transferred from Grafton, W. Va., to Garrett, Ind., effective May 15. J. M. Scott, formerly assistant superintendent, has been appointed superintendent at Grafton, W. Va., succeeding J. F. Keegan, effective May 15.

E. Clemons, who was appointed general superintendent of the Chicago, Milwaukee & St. Paul Ry., at Seattle, Wash., in April, as announced in the May issue of *Railway Engineering*, entered the service of this railway in March, 1874, as station helper on the Prairie Du Chien division. He was later operator and brakeman until 1877, when he was transferred to the River division, and then to Minneapolis, where he held the positions of clerk in freight office, bill clerk, and cashier. In 1880 he entered the paymaster department as clerk, and in 1882 he was made agent at Rushford and later transferred to South Minneapolis, and later in the same year he was appointed clerk to the superintendent of the Iowa and Minnesota divisions. He was transferred as clerk to superintendent, to the Southern Minnesota and Kansas City divisions in 1890. He was then appointed chief clerk to the assistant general superintendent at Minneapolis, and in 1895 was appointed superintendent of the Iowa and Minnesota divisions at Minneapolis. In 1910 he was transferred to the Columbia division of the C. M. & P. S. Ry. at Malden, Wash., and was transferred in 1913 to the Coast division as superintendent at Tacoma, Wash., which position he held until his appointment as assistant general superintendent, lines west of Avery Ida., office at Seattle, Wash.

F. G. H. Hill, formerly trainmaster, has been appointed superintendent of the Chicago, Milwaukee & St. Paul Ry. at Mobridge, S. D., succeeding J. F. Richards transferred to Tacoma, Wash., succeeding E. Clemons, effective March 31. C. H. Marshall has been appointed superintendent at Marion, Ia. W. J. Thiele, formerly trainmaster, has been appointed superintendent at Minneapolis, Minn., succeeding F. H. Myers. F. E. Willard, formerly trainmaster, has been appointed superintendent at Missoula, Mont., succeeding C. H. Marshall.

L. J. Ferritor, superintendent of the Delaware, Lackawanna & Western R. R., has been transferred from Scranton, Pa., to Buffalo, N. Y., succeeding M. H. Cahill. P. N. Place, formerly trainmaster, has been appointed superintendent at Scranton, Pa., succeeding Mr. Ferritor, effective May 7.

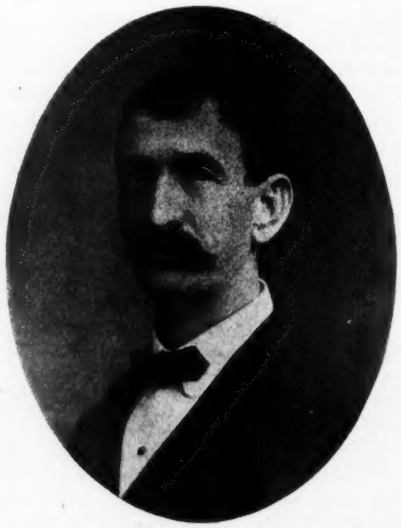
F. P. Gutelius has been appointed general manager of the Intercolonial Ry. of Canada, office at Moncton, N. B.

E. W. Bowans has been appointed general superintendent of the International Rys. of Central America, office at San Miguel, El Salvador, succeeding J. B. Allen.

L. D. Mathes has been appointed general superintendent of the Norfolk Southern R. R. electric division, office at Norfolk, Virginia.

F. M. Smith, formerly roadmaster, has been appointed assistant trainmaster of the Northern Pacific Ry., at Seattle, Wash., effective May 5.

A. S. Johnson, formerly freight agent, has been appointed superintendent of the St. Louis Merchants Bridge & Terminal Ry., and the Terminal R. R. of St. Louis, effective April 23.



D. SULLIVAN, General Superintendent, Apalachicola Northern Ry.

A. F. Helm has been appointed superintendent of the Wabash R. R., at Detroit, Mich., succeeding E. A. Sollit, effective May 1.

Engineering.

W. R. Cullings, formerly assistant engineer, has been appointed engineer western lines, Southern district, of the Atchison, Topeka & Santa Fe Ry., office at Amarillo, Tex. K. B. Duncan, formerly office engineer, has been appointed engineer Gulf lines, office at Galveston, Tex., succeeding R. A. Rutledge, promoted. M. C. Blanchard, formerly division engineer, has been appointed office engineer at Topeka, succeeding Mr. Duncan.

P. J. Carter, who resigned as office engineer of the Gulf, Colorado and Santa Fe Ry., at Galveston, Texas, to engage in post-graduate work at the university of Wisconsin, has reeently been appointed office engineer of the Western Lines of the Atchison, Topeka & Santa Fe Ry., at Amarillo, Texas.

J. B. Adkins has been appointed assistant engineer of the Atlantic Coast Line R. R., at Rocky Mount, succeeding S. Heyward.

W. B. Willis has been appointed assistant engineer of the Baltimore & Ohio R. R. at Poughkeepsie, N. Y., succeeding H. F. Kloss. E. D. Jackson, formerly assistant engineer, has been appointed engineer of the Philadelphia division, succeeding C. C. Cook, transferred to the Pittsburgh division.

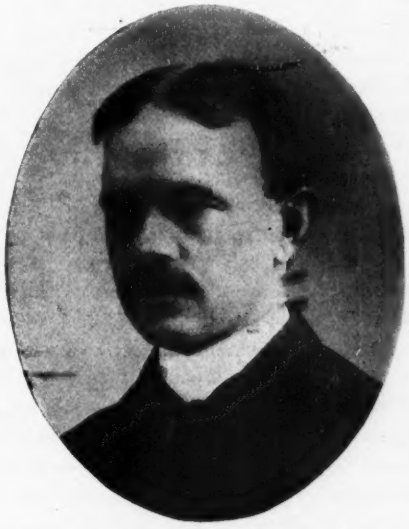
C. R. Chevalier, division engineer of the Boston & Maine R. R., has been transferred from Nashua, N. H., to St. Johnsbury, Vt., effective May 1. A. C. Stickney has been appointed division engineer at Nashua, N. H., succeeding Mr. Chevalier.

E. C. Carter, chief engineer of the Chicago & Northwestern Ry., has been assigned to special work in connection with valuation of the company's property, and the duties of the chief engineer's office will be performed by W. H. Finley, assistant chief engineer, until further notice.

L. J. Putnam, formerly division engineer, has been appointed principle assistant engineer of the Chicago & North Western Ry., office at Chicago. W. J. Jackson, division engineer, has been transferred from Madison, Wis., to Winona, Minn. M. E. Thomas, division engineer, has been transferred from Winona, Minn. to Boone, Ia. These changes were effective May 15.

Lee Jutton has been appointed division engineer of the Chicago & Northwestern Ry., at Madison, Wis., effective May 15. He graduated from the University of Illinois in 1902. He entered the service of the Chicago & North Western Ry. in 1903 in the engineering department. At the time of his recent promotion he was holding the position of inspector of bridges.

W. R. Roof has been appointed assistant engineer of bridges of the Chicago Great Western R. R., at Chicago, succeeding C. Chandler, effective April 15.



F. P. GUTELIUS, General Manager, Intercolonial Ry. of Canada.

W. H. Adey, formerly assistant engineer, has been appointed office engineer of the Delaware & Hudson Co., at Albany, N. Y.

J. W. Barrie has been appointed principal assistant engineer maintenance of way of the Florida East Coast Ry., at St. Augustine, Fla., succeeding R. H. Martin.

F. H. Blackford, locating engineer of the International Rys. of Central America, has been transferred from San Vincent to La Union, El Salvador.

T. J. Burk, division engineer of the Lehigh Valley R. R., has been transferred from Auburn, N. Y., to Hazleton, Pa., succeeding J. A. Zehner.

J. P. Ramsey has been appointed chief engineer of the Lorain, Ashland & Southern R. R., office at Wellington, O.

W. J. Burton, assistant engineer of the Missouri Pacific Ry., has been transferred from Kansas City to St. Louis, Mo. A. W. Neel has been appointed assistant engineer at Monroe, La. P. V. Sherman, assistant engineer, has been transferred from Wichita, Kan., to Kansas City, Mo., succeeding W. J. Burton, effective May 1.

J. D. Block has been appointed resident engineer of the New York Central & Hudson River R. R., at Rome, N. Y., succeeding G. F. Chism transferred to Utica, N. Y., effective May 1, 1913. J. O. Borden has been appointed resident engineer at Syracuse, N. Y. C. R. Diehl has been appointed resident engineer at Presho, N. Y., effective May 1. C. A. McNall, resident engineer, has been transferred from Fishkill to Poughkeepsie, N. Y. B. C. Martin, formerly resident engineer, has been appointed assistant district engineer at Poughkeepsie, N. Y. H. M. Park has been appointed resident engineer at Little Falls, N. Y.

W. H. Moore, formerly engineer of bridges, has been appointed engineer of structures of the New York, New Haven & Hartford R. R., at New Haven, Conn. C. W. Lord has been appointed office engineer at New Haven, Conn., effective May 1.

Arthur R. Carver has been appointed chief engineer of the Orange-Northeastern Ry., office at Natchitoches, La., effective May 1. He formerly held the positions of chief engineer of the Alton, Roswell & New Mexico Ry., locating engineer on the Mexico Northwestern Ry., and locating and division engineer on the Southern Pacific R. R., of Mexico. On August 1, 1912, he was appointed division engineer of the San Benito & Rio Grande Valley Ry., at Mission, Tex., which position he held till his appointment as chief engineer as noted above.

LEE JUTTON, Division Engineer, Chicago & North Western Ry.

H. Gordon, formerly assistant engineer, has been appointed right-of-way engineer of the Southern Ry., office at Washington, D. C. A. Harris has been appointed assistant engineer at Birmingham, Ala.

John Carmichael, engineer maintenance of way of the Western Maryland Ry., has been transferred from Baltimore to Hagerstown, Md.

Bridges and Buildings.

F. C. Rand has been appointed supervisor of bridges and buildings of the Boston & Maine R. R., at Nashua, N. H., succeeding A. Mountfort, effective May 1.

E. E. Clothier, master carpenter of the Chicago, Milwaukee & St. Paul Ry., has been transferred to Malden, Wash., in charge of territory from Deer Lodge, Mont., to Othello, Wash. including the St. Maries and Warden branches, the Plummer branch to Spokane, and the Coeur d' Alene line, effective April 28. E. E. Collings, formerly master carpenter at Malden, Wash., has been transferred to Perry, Ia., succeeding Mr. Clothier, effective April 28.

Robert Brown, master carpenter of the Great Northern Ry., has been transferred from Havre, Mont., to Everett, Wash. A. M. Webber has been appointed master carpenter at Havre, Mont., succeeding Mr. Brown.

G. A. Rodman, formerly inspector of bridges and buildings, has been appointed general supervisor of bridges and buildings of the New York, New Haven & Hartford R. R., at New Haven, Conn.

Concrete Bridges—Their Behavior Under Flood Conditions.

The recent spring floods in Ohio and Indiana devastated nearly all structures in their direct paths, railway and highway bridges alike being carried away. In some cases all that remained of heavy plate girder bridges was the track, ties and rails spanning from pier to pier. The bridges, especially in the case of highway bridges, which withstood the flood in the best manner were of concrete. In one particular section of Indiana the only bridge which was not destroyed was one of reinforced concrete. At Decatur, Ind., a reinforced concrete bridge was completely submerged by the flood, but subsequent examination showed it to be in good condition. At Zanesville, Ohio, the only two bridges for a distance of 85 miles that were left standing on the Muskingum River were a high level steel bridge and a large reinforced concrete arch bridge. Only the hand rails of this latter bridge were destroyed, no doubt because they were not sufficiently reinforced and anchored to the structure.

In Indianapolis only one of the many concrete arch bridges across the White River and Fall Creek was damaged. This was the Meriden St. bridge, built on the Melan System. Due to a great deal of dredging by gravel companies near the site of this bridge the foundations which were not on piles were, no doubt, somewhat weakened and during the flood the foundations were undermined still further and the arch rings split in half, longitudinally, probably because of lack of transverse reinforcement. The piers were still standing, as was one-half the bridge, while the upstream half was suspended from the piers and partly submerged. The other concrete bridges in the city were not damaged in the least although some of them were nearly submerged.

Reinforced concrete arch bridges at Main Street, Dayton View, Third Street and Washington Street; Dayton, Ohio, withstood the flood which all but submerged the middle spans, in a remarkable manner. Beyond the loss of a few feet of hand rail or balustrade they are apparently in as good condition as ever.

At Peru, Indiana, the crest of the flood was three feet above the top of hand rail of a two span reinforced concrete arch. In addition to this an immense amount of lumber was piled up against the bridge; in spite of this no damage was done.

The Tennessee Avenue bridge, at Ft. Wayne, Indiana, although the water rose to within a few inches of the crown of the arch and the structure was subjected to the great pressure of masses of debris and rushing current, was uninjured.

This record of stability during almost unprecedented flood conditions is one which will do much to bring about the more extensive use of concrete bridges. After such experiences people can have nothing but confidence in concrete structures.

We do not wish to convey the impression that any concrete bridge, no matter how it is constructed, will be able to withstand these conditions, but rather to impress the fact upon our readers that when care is exercised in construction, especially in the matter of foundations, a concrete bridge is more nearly immune to damage than any steel structure.

The greater dead weight of a concrete structure as compared with a steel bridge, capable of carrying the same load, is no doubt an important factor in the great stability possessed by the former class of bridges. Then again, the rigidity of the concrete structure as a whole, compared with that of a steel bridge, is responsible in no mean way for the power which the former possesses in resisting external forces which are not taken into consideration in design.

The Meriden Street bridge at Indianapolis, can be cited as an example of the absolute need of transverse reinforcement in concrete arches. The added security and stability acquired by the use of a comparatively small amount of additional reinforcement offsets many times the extra cost of the steel, and it can therefore be considered economy to use the extra steel. For this reason if no other, arches proportioned and designed as plain concrete structures should have sufficient transverse and longitudinal reinforcement placed at the extrados and intrados of the arch ring to securely tie the entire mass of concrete together. In such cases the arch rings will be able to resist most of the secondary stresses not taken into account in design, such as are produced by huge ice jams or floods.

The lessons taught by such great disasters are many, and it is the duty of every engineer to intelligently combine this "practical" knowledge with "theoretical" facts in order that engineering design standards be raised to a higher and safer plane.

Theory and Design of Reinforced Concrete.

The review of "Reinforced Concrete Construction," by G. A. Hool elsewhere in this issue, brings to mind some points regarding design of reinforced concrete which are not always treated in the best or most logical manner. Practical considerations are often ignored when they seem to conflict with mathematical theory, or their avoidance can be justified by "mathematical gymnastics," in order to show a saving over some other design. This is especially true of commercialized engineering design as it is now so extensively practiced.

At the present time the design of reinforced concrete is supposed to have reached a comparatively high state of de-

velopment. It is needless to say, however, that a great deal still remains to be done before we can justly say that concrete design is on as intelligent and practical basis as structural steel design. After looking over numerous designs for concrete buildings by a number of different engineers claiming to be experts on reinforced concrete design, we cannot help but feel that many engineers are sadly lacking in their knowledge of the stresses in concrete beams. Many perhaps do know better, but for the benefit of their business and the fear of competition, items of vital importance are passed over with little or no attention.

We see altogether too many designs of continuous beams and girders where only one-third to one-half enough steel is provided in the tops of the beams and girders over the supports to care for the negative moments at the same unit stresses as are used for the middle portions between supports. Often no provision is made for compression in bottoms of T-beams at supports. As is to be expected, the offenders justify their claims by citing examples designed in this manner which are standing up under the loads imposed without any apparent signs of failure. This is nothing more than what might be called "flirting with the factor of safety;" the man who is willing to take the most chances being the one who gets the business in these days of competition. Nowadays too much competition is based on that which can be taken from the factor of safety, and for this reason it might be well to change this useful engineering phrase to the "factor of competition."

The fact that both the steel and concrete sections over the supports of continuous beams are not always sufficient over the supports of concrete beams is often due to that pernicious practice of assuming that the total moment in a beam equals, say $1/6\ wl^2$, and then selecting a certain bending moment coefficient for center of span, which is less than that for the total moment, the difference between the two being the coefficient for the moment at the support. This method, while nearly correct for interior spans, is truly an idealistic method, but it is a hard and undeniable fact that bending moments, especially in end spans, are not what we wish to make or would like to have them, but are governed by actual conditions.

There is no time like the present to start a campaign against such "rules of thumb" and the strenuous attempt now being made to use the factor of safety, which enters into all good engineering designs, as a "factor of competition." Let us not enter the same rut which made steel highway bridge design and construction the disgrace of the engineering profession a few years ago.

Plastering Concrete Surfaces.

IN THIS northern region the practice of plastering concrete surfaces to remove form marks and smooth up the roughened surfaces left by the forms has proven anything but satisfactory. The variations of temperature aided by variations in moisture soon play havoc with a plastered concrete surface. We frequently see structures which were plastered or brush coated with cement mortar to cover up the form marks and the imperfections in the surface of the concrete, which after about a year present a very patchy and spotty appearance, due to the flaking off of the mortar.

The causes of these defects are numerous and it is therefore difficult to say just what the cause may have been in any particular case.

In general when a concrete wall is poured the surface is coated with a film of cement, if the concrete is mixed wet, and this film produces a relatively smooth surface to which it is difficult to make a mortar coating stick. If the mortar does stick for a time it gradually loses its grip due to the shrinkage of the mortar while hardening, coupled with the effect of the difference of the coefficients of linear expansion of the mortar and the concrete, due to temperature changes.

It is a fact that a rich mortar such as is generally used for this work shrinks considerably more than the leaner mixture of concrete upon which it is plastered. This difference in shrinkage, with greater relative movement in the finish, causes it to lose its bonds to the mass of concrete in places and it drops off, leaving unsightly patches and spots in the surface.

Even when a mortar facing placed at same time as concrete is used cases arise where the difference in contraction between the facing and the backing causes cracking and spalling of the surface. The same is true of concrete surfaces coated with a cement wash applied with a brush. Even when care is exercised in roughening the concrete surface and removing the surface film of cement the results in nine cases out of ten are unsatisfactory. Various preparations are advertised which are said to give a positive bond between a concrete surface and plaster coat, but even these can not be used with any marked success.

If a concrete surface as left by the forms must be finished in some way for appearance sake, it can be said with truth that plastering or brush coating is simply "jumping from the frying pan into the fire." Plastered concrete surfaces have been tried and been found wanting too often to have them specified on any job.

A surface finish which is better, cheaper and more durable is the concrete surface rubbed with carborundum or cement bricks before the concrete is very old. The cost of finishing concrete surfaces in this manner ranges from 1½ to 3 cents per square foot, depending on the nature of the work, i. e., whether plain or broken up by reveals, panels and mouldings. The surface produced by rubbing is of a lighter color than the ordinary concrete surface, is more nearly impervious, does away with form marks and, in fact, is the ideal method of low cost finish for concrete work.

Bush-hammering, sand-blasting and acid-washing are used to some extent, but any of these methods of finishing are too costly for use on the ordinary concrete structure, and are limited to use on the finer class of concrete structures where cost is of secondary importance.

The St. Louis Southwestern is reported to have prepared plans for the construction of new freight terminals at Fort Worth, Tex.

The Union Pacific, it is reported, has awarded contract to the American Bridge Co. for 6,000 tons of steel for a viaduct at Spokane, Wash.

OVERHEAD HIGHWAY ARCH OF ARTISTIC DESIGN.

A. M. Wolf.

The reinforced concrete highway arch bridge over the tracks of the N. Y., N. H. & H. R. R. at South Park, Fall River, Mass., completed in 1912, is architecturally one of more than ordinary design. This structure over three railroad tracks has a clear span of 82 ft. 6 in. and a total length of 89 ft. 2 in. out to out of balustrade. The arch ring, of reinforced concrete, which is three-centered, with an apparent rise of 14 ft. 10 in. and an actual rise of 9 ft. 2 in., is 1 ft. 8 in. thick at the crown and 3 ft. 6 in. thick at the springing. The spandrels are gravity walls retaining earth fill supporting pavement and walks. They are finished off at the top with a corbeled coping and a solid paneled handrail of reinforced concrete. The abutments are of plain concrete with straight wings reinforced near the inner face. The roadway, of brick on concrete base, is 25 ft. wide and is flanked on either side by two 8-ft. sidewalks.

The architectural treatment of this bridge is another fine example of the unlimited possibilities of individuality to be obtained at a small extra expenditure. The triangular inset panels in the spandrel walls at either side of the crown between the extrados and spandrel coping and the handrail panels are bush-hammered and present a very pleasing contrast to the rubbed surface of the rest of the structure. The solid concrete handrail, although it is very plain architecturally speaking, is well proportioned and finished, and adds much to the beauty of the arch. This bridge, as the illustration shows, is one of very graceful lines, such as harmonize very well with its surroundings in a residence district.

Fall River Overhead Highway Bridge.

Design.

The loadings used in design were: Dead load, concrete and pavement, 150 lb. and earth filling 120 lb. per cu. ft.; live load, sidewalks, 100 lb.; roadway, 150 lb. per sq. ft., and a concentrated load consisting of a 20-ton steam roller.

The maximum allowable compression in the arch ring, not including temperature stresses, was 500 lb. per sq. in.; including temperature stresses, was 700 lb. per sq. in. A maximum shear of 75 lb. per sq. in. was allowed. The ratio of moduli of elasticity of steel and concrete was taken as 20.

The arch was designed with a theoretical rise of 9 ft. 2 in. for a circular segmental arch with an intradosal radius of 97 ft. 6 in. and an extradosal radius of 111 ft. 8 in. To improve the appearance of the arch a short radius curve (9 ft. 0 in.) was put in at each abutment, giving the appearance of a three-centered arch with an apparent rise of 14 ft. 10 in. At a point 11 ft. 3 in. out from either abutment the clearance above top of rail is 18 ft., the clearance at the crown being 22 ft. 10 in.

The arch ring, 45 ft. wide, is reinforced longitudinally only, with 1-in. corrugated square bars, 12 in. centers, placed 2 in. clear from extrados and intrados, bent to the curve of the arch ring. The ends of these rods extend into the abutments and are fitted with nuts and washers to provide positive anchorage. The bars in the two layers are placed directly above one another and every second pair is tied together with ½-in. corrugated square, hooked shear bars spaced about 2 ft. centers, as shown in illustration.

The spandrel walls, 2 ft. 6 in. wide at the top of coping, have vertical faces and back batters of 3 in. to 1 ft. The walls are reinforced near outside faces with ½ in. corrugated squares 2 ft. centers both ways, and are doweled to the arch ring at face and back by ½ in. dowels, 5 ft. long, extending 15 in. into the arch ring.

The hand rail, consisting of slightly battered posts 3 ft. 10 in. high with 1 ft. 7 in. by 2 ft. 3 in. top dimensions, spaced about 12 ft. 3 in. centers, with a solid paneled wall 3 ft. 6 in. high, with top and bottom rail between posts. The posts are doweled to the spandrel with short dowel bars and the intermediate rail is anchored with ¾ in. corrugated square dowels 4 ft. long projecting 15 in. into the spandrels. Near the top of the beveled rail longitudinally between posts are placed two ½ in. sq. bars. At the ends of the bridge the handrail returns at 90° out over the straight abutments for about 8 ft., terminating in a heavy concrete pedestal for ornamental lighting standards to be erected later.

The abutments are 45 ft. long and 25 ft. wide at the footings, which are 4 ft. thick and project 1 ft. beyond the abutment proper at sides and back and 6 in. at the front. The abutment face is vertical with a 3 in. projecting coping 12 in. deep just below the apparent springing line. The back of the abutment is battered at 45 deg. for a height of 14 ft., where it intersects the extrados of the arch ring. The abutments are doweled to footings by ¾ in. sq. dowels 5 ft. long spaced 2 ft. centers both ways.

The wing walls, 44 ft. long, are straight, being continuations of the abutment face, but built separately. They are the plain concrete gravity type with some vertical reinforcement near the inner face in the form of ¾ in. sq. bars spaced 5 ft. centers vertically. The wings have a level top for some distance out from the arch, and then slope at a 1½ to 1 slope to the ground, the connection between the level and sloping portions being made with a neat curve. The walls have copings 20 in. wide and 8 in. thick, and back batters of 0.35 ft. to 1 ft. The wings

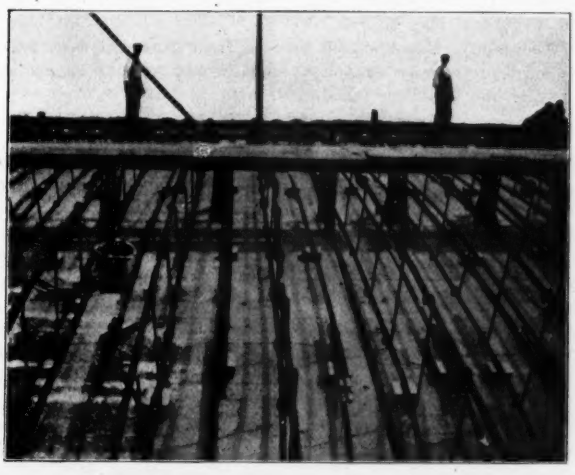
are doweled to the footings, 4 ft. thick, with ¾ in. sq. bars 5 ft. long spaced 3 ft. centers.

Concrete.

The concrete used in the abutments was a 1:2½:5 mixture, the coarse aggregate being crushed stone passing a 2 in. ring. The arch ring, spandrels and balustrades are of 1:2:4 concrete, with 1 in. stone. All exposed surfaces have a 1:2 mortar surface finish, placed at the time of pouring concrete by means of iron facing plates placed about an inch from the forms and moved up as concreting progressed.

Expansion Joints.

Expansion joints are provided in spandrel walls, sidewalks and balustrades at points coinciding with the face of abutments. The joints are formed by sheets of corrugated asbestos board about ⅜ in. thick, protected by lead plate folded into the points. Those in the walks were still further protected by a coating of asphalt.



Detail of Reinforcing, Fall River Bridge.

Construction.

Centering—The requirements of the city and railway were such as to necessitate the use of a somewhat unusual type of centering for an arch of this size and character. These requirements called for a final clearance of 18 ft. at a point 11 ft. 3 in. from the abutment face or right of way line, while during construction a temporary clearance of 15 ft. 6 in. from top of rail for a distance of 40 ft. over the 3 tracks had to be maintained at all times, no blocking of traffic being allowed.

The 40 ft. span over the tracks, which are located to one side of the center line right of way, was made by means of eight wooden Howe trusses with broken top chords to more nearly fit the arch curve, spaced about 6 ft. 1¾ in. centers, covered with 2 in. tongue and grooved lagging. The chord members of the trusses were 10x10 in. stuff, the diagonals 8x8 in., and the verticals 4x10 in., with 1¼ in. dia. rods as tension members.

The ends of the trusses rested on vertical framed bents with 8x8 in. uprights, about 3 ft. centers, resting on concrete mud-sills and capped with an 8x12 in. timber. The trusses were braced transversely by 8x10 in. timbers resting on the bottom chord at each panel point. The remainder of the form work was of the ordinary frame bent type, sway braced transversely, and horizontally braced at right angles to tracks, with four bents on one side of truss and three on the other. The verticals supported 4x10 in. stuff longitudinally, the end points of which were braced by 4x9 in. diagonals extending from about the middle point of the upright frames to the top chord. All verticals were set on double wedges resting on the concrete mud sills. The 2 in. spruce lagging for the arch ring form rested on 2x6 in. pieces placed on the top chord of trusses and bents, these pieces having been cut to the curve of the arch. The centering was designed for a maximum deflection of 1/800th of the span. Forms for finished work were of best quality cypress or white pine, tongued and grooved and not less than ⅞ in. thick. Quarter rounds were built in all corners as directed by the engineer.

Concreting—The abutments were poured in 6 in. layers as nearly continuous as possible, with bars anchored into them at the skew back of the arch to lap with the longitudinal bars in the arch ring, the abutments being completed late in the fall of 1911 and the arch ring the following spring. Vertical rebates were left in the abutments for connection of wings, which were built separately after the arch was completed.

The arch ring was poured in a continuous run, two gangs of men with separate derricks and hoists working from opposite ends of the arch and meeting at the crown. The arch was turned in 29 hours, starting at 5 a. m. July 3 and finishing at 10 a. m. July 4, 1912. The concrete was mixed in batch mixers and fed directly into buckets from the mixers.

The spandrel wall was built monolithic, leaving a rabbet for the panel work in the balustrade, which was built later.

Waterproofing—The top of arch ring, and back of abutments to footings, and the spandrels for a height of 6 in. above the arch ring, were waterproofed with two coats of asphalt cut with naphtha.

Surface Finish—The soffit of the arch was rubbed with carborundum stone after removing forms, and any voids found were grouted, so as to leave the concrete with a smooth surface.

All exposed parts of the bridge, including balustrades inside and outside, spandrel walls, exposed parts of the arch, ring, wing walls and the face of abutment below the springing, had a special mortar facing and were finished as follows: After the forms were removed, the concrete was thoroughly washed with a brush and rubbed with a coarse No. 16 carborundum stone, bringing the surface to a lather. After the rough projections were removed the lather was washed off with a brush, the concrete was again wet down and dusted with a 1:1 dry mixture of cement and sand. This was rubbed into the surface with a No. 16 carborundum stone, care being exercised to not allow any mortar to remain on the surface. The final rubbing was then done with a No. 30 or fine carborundum stone. The panels in spandrel walls and balustrade were bush-hammered when the concrete had become quite hard.

The results of the above described method of surface finish are very fine as shown by the illustration of the structure.

We are indebted to J. I. Higgins, architect and engineer for the bridge, for the information and illustrations contained herein.

CONCRETE IN RAILROAD WORK.*

By M. A. Long, Assistant Chief Engineer, B. & O. R. R.

Concrete is now being used probably more than any other building material and is considered by some as being infallible and a substitute for every other building material; but it must be given proper treatment or it will be sure to cause trouble. The railroads which are, to my mind, the master builders are using millions of barrels of cement every year, and each succeeding year sees them using concrete for a greater number of structures.

Concrete, properly used, is perhaps the most permanent building material used today, but because it is such and because the railways are really in their infancy, there are some structures they hesitate to make too permanent. Were it not for the demands of progress the majority of all buildings would be built of concrete; but tearing down concrete is difficult, expensive and wasteful and therefore many buildings are built of other materials, where it is certain they are not to be permanent.

Concrete has been used by the B. & O. R. R. for three water tanks where large storage and high pressures are needed. From experience gained it is recommended that concrete structures

*Abstract of a Paper Presented at the Pittsburgh Meeting of the National Association of Cement Users.

of this character be coated inside and outside with waterproofing and be allowed to cure before water is put in.

Reinforced concrete under pits (where hot cinders are dumped and drenched with cold water) have been built. It has been found that in these structures the concrete must be faced with vitrified brick as alternate heat and cold will spall concrete. Slag has been used as a substitute for stone in the concrete in these pits, and has been found to be an improvement but not entirely satisfactory.

In repairing leaks in a cinder concrete base for a passenger subway it was found that the cinder concrete, made from soft coal cinders, had not set up. Others have had this same experience. On testing we found that soft coal cinders contain a great deal of sulphur. This is not true of hard coal cinders, and the latter are the only kind that should be used in concrete.

A reinforced concrete engine house with wooden roof has been constructed, the roof being of wood because of the fear of condensation of steam on the cold concrete ceiling and consequent dripping off on the engine jackets.

Waterproofing was applied to the outside of walls of a reinforced concrete grain elevator which gave trouble with dampness at times during hard rains, and it remedied the trouble.

During the past year it was found that watch boxes and telephone booths of reinforced concrete could be bought cheaper than they could be built of wood, and they have therefore been adopted as standard.

In making plans for some small shop buildings, within the past year, wood construction was specified; also steel frame covered with metal lath, plastered both sides with cement mortar, making a wall approximately 3 inches thick. It was an agreeable surprise to find that the bids for the latter type were as cheap as wood construction, and of course concrete was adopted.

There are many reasons why concrete is chosen in preference to other material, some of them being as follows:

(1). Its rigidity, especially in buildings containing machinery. Vibration in a properly constructed concrete building is negligible.

(2). Low cost of maintenance.

(3). Fireproofness. We consider concrete structure so nearly fireproof that we carry little or no insurance on them. The contents, however, are insured.

(4). Waterproofness. Reinforced concrete when properly mixed, can be made practically waterproof against small pressures. It should be mixed wet and worked well into place.

(5). Cost. Compared with a structural steel fireproof building its cost is lower, but it is more expensive than ordinary mill construction.

We find that concrete floor surfaces dust badly and it is necessary to resort to the use of linseed oil and shellac; or to hot silicate of soda, which eliminates the dust for a time. Tests are now being made with Ironite worked into a rich mixture, for wearing surface, and while this increases the wearing qualities, it is not as satisfactory as could be wished.

Another adverse feature of concrete is contraction cracks. As concrete cures it has a tendency to crack, and this gives it the appearance of having veins, especially so where moisture has had a chance to enter through these small cracks. A great deal of this is, no doubt, caused by finishing the surface with a very rich mixture. Should it be necessary to patch voids in the surface the mixture should be no richer than the mass: On the B. & O. R. R. all concrete surfaces are specified to be finished by rubbing with a concrete brick.

Adolphus Bonzano, bridge builder and inventor of the Bonzano rail joint and other railroad appliances, died at his home in Philadelphia, Pa., on May 5, at the age of 83.

George W. Craven, manager of the Chicago office of the C. & C. Electric Co., has been made manager of the welding department of that company, with headquarters at Garwood, N. J., succeeding George A. Hills, resigned.

ABSTRACTS FROM SPECIAL COMMITTEE REPORT ON CONCRETE. A. S. C. E., 1913.

The subject matter pertaining to destructive agencies is much the same as that included in the masonry committee report A. R. E. A. 1913 (page 204 of April issue of Ry Engr'g.) and therefore will not be given here.

The subject matter on materials contains nothing which departs from the usual practice or that is new and will not be included in this article.

Metal Reinforcement.

Steel filling the requirements of the A. R. E. A. specifications for structural steel reinforcement is recommended.

Where little bending is required and also for reinforcement for shrinkage and temperature stresses material filling the requirements of the specifications of the A. R. E. A. for high carbon steel, may be used adopting the same unit stresses hereinafter recommended for structural grade material.

For the reinforcement of slabs, small beams, or minor details or for temperature reinforcement, wire drawn from bars of rivet steel may be used.

The reinforcement should be free from excessive rust, scale or coatings of any character which would tend to reduce or destroy the bond.

Preparing and Placing Mortar and Concrete.

Proportions:—The materials to be used should be carefully selected, of uniform quality and proportioned with a view to securing as nearly as possible a maximum density.

The fine and coarse aggregates should be used in such relative proportions as will insure maximum density. In unimportant work it is sufficient to do this by individual judgment, using correspondingly higher proportions of cement; for important work these proportions should be carefully determined by density experiments, and the sizing of the fine and coarse aggregates should be uniformly maintained or the proportions changed to meet the varying sizes.

For reinforced concrete construction one part of cement to a total of six parts of fine and coarse aggregates measured separately, should generally be used. For columns, richer mixtures are generally preferable, and in massive masonry or rubble concrete, a mixture of 1:9 or even 1:12 may be used. These proportions should be determined by the strength or the wearing qualities required in the construction at the critical period of its use. For all important construction, advance laboratory tests should be made of all concrete of the materials, proportions and consistency to be used in the work.

Mixing.—The ingredients of concrete should be thoroughly mixed and the mixing should continue until the cement is uniformly distributed and the mass is uniform in color and homogeneous. As the maximum density and greatest strength of a given mixture depend largely on thorough and complete mixing, it is essential that work of mixing should receive special attention and care. Inasmuch as it is difficult to determine, by visual inspection, whether the concrete is uniformly mixed, especially where limestone or aggregates having the color of cement are used, it is essential that the mixing occupy a definite period of time. The minimum time will depend on whether the mixing is done by machine or hand. When mixing with a machine the operation should continue for a minimum time of at least 1 minute after all ingredients are assembled in the mixer. When mixing by hand especial precautions should be taken to turn all the ingredients together at least six times and until they are homogeneous in appearance and color.

The materials should be mixed wet enough to produce a concrete of such a consistency as will flow into the forms and about the metal reinforcement when used, and which, at the same time, can be conveyed from the mixer to the forms without separation of the coarse aggregate from the mortar.

Mortar or concrete should not be remixed or retempered with water after it has partly set.

Placing Concrete.

Methods.—Concrete after mixing should be handled rapidly and in as small masses as practicable and under no circumstance should concrete be used that has partly set.

Concrete should be deposited in such a manner as will permit the most thorough compacting, such as can be obtained by working with a straight shovel or slicing tool kept moving up and down until all the ingredients have settled into their proper places by gravity and the excess water has been forced to the surface. Special care should be taken to prevent the foundation of laitance, which hardens very slowly and forms a poor surface on which to deposit fresh concrete. All laitance should be removed. (See editorial page).

Before depositing concrete, the reinforcement should be carefully placed in accordance with the plans and adequate means provided to hold it in proper position until the concrete is deposited. (See editorial page 222, April issue Ry. Engr'g.). When the placing of concrete is suspended, all necessary grooves for joining future work should be made before the concrete has set. When work is resumed concrete previously placed should be roughened, thoroughly cleansed of foreign material and laitance, thoroughly wetted and then slushed with a 1:2 cement mortar. The faces of concrete exposed to premature drying should be kept wet for at least 7 days.

Freezing Weather.—Concrete should not be mixed or deposited at a freezing temperature unless special precautions are taken to avoid the use of materials covered with ice crystal or containing frost, and to provide means to prevent the concrete from freezing after being placed in position and until it has thoroughly hardened. As the coarse aggregate forms the greater portion of the concrete, it is particularly important that this material be heated to well above the freezing point.

Rubble Concrete.—Where concrete is to be deposited in massive work, its value may be improved and its cost materially reduced by the use of clean stones thoroughly embedded in the concrete as near together as is possible and still entirely surrounded by concrete.

Under Water.—In placing concrete under water it is essential to maintain still water at the place of deposit. The use of tremies properly designed and operated, is a satisfactory method of placing concrete through water. The concrete should be mixed very wet so as to flow readily through the tremie and into place with a practically level surface.

The coarse aggregate should be never more than an inch in diameter. The use of gravel facilitates mixing and the flow through the tremie. The mouth of the tremie should be buried in the concrete at all times, entirely sealed and the surrounding water prevented from forcing itself into the tremie; the concrete will then discharge without coming into contact with the water. The tremie should be suspended so that it can be lowered quickly when it is necessary either to choke off or prevent too rapid flow; the lateral flow should preferably be not more than 15 ft. The flow should be continuous in order to produce a monolithic mass and prevent the formation of laitance in the interior.

In large structures it may be necessary to divide the mass into several small compartments, filling one at a time. With proper care, it is possible in this manner to obtain as good results under water as in the air.

Forms.

Little more and even less than is usually found in text books is said on this important subject and it is therefore not given in this abstract.

J. W. Cleary, one of the oldest electric headlight men in the country, who joined the forces of the National Electric Headlight Co. in Indianapolis in 1891, and in 1899 became associated with the Pyle-National Electric Headlight Co., Chicago, as traveling engineer, has resigned his position and will go abroad for several months.

STRUCTURES.

The Baltimore & Ohio has awarded a contract to James Stewart & Co. for the construction of a large grain elevator in the Calumet river district, South Chicago, to have a capacity of 875,000 bushels.

The Canadian Pacific, it is reported, has awarded contract to the Canadian Stewart Co., for the building of an addition to its grain elevator at Fort William, Ont.

The Chicago & Alton is reported to have plans for a new depot at Normal, Ill. This road is also said to have awarded a contract amounting to $103,000 to the George B. Swift Co., Chicago, for 30-stall round house, coal tipple and ash pit at Glenn, Ill.

The Buffalo, Rochester & Pittsburgh has awarded a contract to the American Bridge Co. of New York for a double track bridge over the Allegheny river at Riverside, Pa.

The Chicago and North-Western, it is reported, will built another ore dock east of its present docks at Ashland, Wis., next winter. It will be of steel and concrete construction and will cost about $1,000,000.

The Chicago, Indianapolis & Louisville, it is reported, is having plans prepared calling for an expenditure of $110,000 for terminal improvements at Michigan City, Ind.

The Duluth, South Shore & Atlantic is said to have closed contracts for 1,300 tons of bridge material for viaducts and girder spans at various points on its lines. It has also been announced that this road will build a 15-stall roundhouse and a 75-foot turntable at Marquette, Mich.

The Grand Trunk Pacific has awarded the following contracts for construction work: McLelian Creek crossing, 249 ft.; Little Shuswap crossing, 129 ft.; Rau Shuswap crossing, 1,032 ft.; Cottonwood Creek crossing, 129 ft.; Fifty Mile River crossing, 129 ft.; Goat River crossing, 308 ft.; Dome Creek crossing, 129 ft.; Second Fraser River crossing, 689 ft.; Third Fraser River crossing, 968 ft.; Willow River crossing, 459 ft.; Fourth Fraser River crossing, 1,227 ft.; Upper Nechaco River crossing, 642 ft.; Bulkley River crossing, mile 1,481, 254 ft., and Bulkley River crossing, mile 1,486, 364 ft.

Several bridges will be built over streets in Vancouver, B. C., in connection with the new plan of grade crossings of the Great Northern in that city. The total estimated cost of these structures is $618,700.

The Kansas City, Mexico & Orient is reported to have plans for improvements at Sweetwater, Tex., to include the construction of a freight and passenger depot, to cost about $100,000.

The Lehigh Valley, it is reported, has awarded a contract to the American Bridge Co. for a bridge over the Lehigh river.

The New York Central & Hudson River is said to have closed contracts for a Scherzer lift bridge and plate girders to be erected at Peekskill, N. Y.

The New York, New Haven & Hartford is reported to have abandoned plans for the construction of a bridge across the Taunton river, the cost of which was estimated at $2,400,000.

The Pennsylvania has given an order to the American Bridge Co. for 3,500 tons of structural steel to be used in replacing five bridges swept away or damaged in the floods. This road will also build a creosoting plant at Middletown, Pa.

The Pittsburgh & Lake Erie has awarded a contract for roundhouse, shop, storeroom and power house to be erected at Dickerson Run, Pa., at an estimated cost of $75,000.

The Spokane, Portland & Seattle has announced plans for the expenditure of $200,000 for roundhouses, car shops and storage tracks at Spokane, Wash.

The Western Maryland is reported to be preparing plans for locomotive repair shops at Hagerstown, Md., which will involve an expenditure of $250,000.

New Books

REINFORCED CONCRETE CONSTRUCTION—Vol. 1—Fundamental Principles—Prepared in the Extension Division of the University of Wisconsin, by Geo. A. Hool. Cloth, 6x9½ in.; 254 pages, 88 figures. Published by McGraw-Hill Book Co., New York. Price, $2.50 net.

This is the first of a set of three volumes being prepared by the Extension Division of the University of Wisconsin for use in its correspondence school course in reinforced concrete. Only the fundamental principles of design are treated in this volume, the details of design and construction being left for subsequent volumes. Although designed to meet the needs of the correspondence school student, it should prove an excellent school-room text and reference book because of its remarkable clearness and logical treatment. Perhaps the original purpose of the volume has had much to do with ever present clearness of text; the thought ever foremost in the author's mind being to make the work "self-explanatory," which it should be to fufill the needs of the correspondence student. To say that Mr. Hool has succeeded in doing this is putting it but mildly; it indeed stands out in happy contrast to some of the complicated and involved treatises on reinforced concrete previously published.

The book is primarily one treating of the design of reinforced concrete, the first part on properties of material is included only to convey to the student the general ideas as to the properties of the various materials and their behavior when combined in reinforced concrete construction. In Part II the theory and design of slabs, beams and columns is treated in a most clear, concise and logical manner, with a minimum amount of involved mathematics. The subject of diagonal tensile stresses and the proper design of web reinforcement in beams and girders is covered in a way which is to be commended. Most of our American books on the subject place too little stress on the treatment of diagonal tensile stresses in beams and it is indeed gratifying to have a book placed at our disposal in which the student is given something besides glittering generalities and complicated mathematics with which to fit himself for the work of designing reinforced concrete beams and girders in an efficient manner.

Mr. Hool has taken a step in the right direction by avoiding those minutely accurate formulae (especially for T beams) which are characteristic of so many text books on reinforced concrete. Why should the effective depth of a beam be calculated to the nearest hundredth of an inch, for when the steel is put in place it may not be within a ¼ or ½ inch of the assumed position? What we need in reinforced concrete design is more common sense application of the laws of mechanics and less fine spun theory based on assumptions which vary greatly in every case.

Numerous diagrams and tables for the design of slabs, beams and columns are given with illustrative examples of their use. These are of especial value in checking designs. The last chapter treats of the analysis of combined bending and direct stress in a most commendable manner.

The general arrangement, typography and the illustrations, are of the best and for ready reference Mr. Hool's book should occupy a place in the library of every engineer and designer.

EARTHWORK, HAUL AND OVERHAUL. By J. C. L. Fish, 6x9, cloth, 165 pages, illustrated. Published by John Wiley & Sons, New York City. Price $1.50.

Haul and overhaul have probably been the cause of more lawsuits and disputes between contractors and railroads than any other one thing. In many cases the contractor being shrewd and crafty has tried (and often succeeded) to show that he should be credited with overhaul because he had foresight enough to handle a job in such a manner as to overhaul some material in order to handle the remainder at a lower cost with a resulting benefit to himself. Then, again, the engineers in charge have been just as crafty in preventing the contractor from obtaining payment for overhaul which was justly due him. Such actions as above cited have led engineers and contractors to sidestep the matter of overhaul as much as possible in order to avoid trouble.

The need of a book on this subject has long been felt by engineers, contractors, students and teachers, and this new book by Mr. Fish, at one time Division Engr. L. S. & M. S. Ry., is the first one to fill the want in a satisfactory manner to all concerned.

The purpose of the book is to answer all questions on computation of overhaul and on the use of the mass diagram in planning distribution, which have arisen during an experience covering a wide range of conditions.

The first part of the book is a full presentation of each of the elements of overhaul computation, such as, the preliminary consideration showing the necessity of adopting an ideal distribution, instead of the actual as a basis of computing haul and overhaul; the mass curve; limits and center of mass of a body of material; methods of finding the center of gravity of a body of material, with a digest of American practice in computing overhaul. Then follow methods of computing overhaul for simple and complex cases each illustrated by an actual example.

Part two treats of the economic distribution of material along the profile, the effect of swell on planning distribution and the limit of profitable haul, together with methods of application of the economic principles of distribution by the use of the mass curve.

Much has been drawn from the treatment of overhaul in Am. Ry. Eng. Ass'n. proceedings of 1906, the specifications given therein being used as a basis for all problems worked in this book. This makes the book one of great value since it is based on the best American practice and not on some theoretical idea alone.

Most books on railway engineering treat of the subject of overhaul in a page or two and this extended and carefully prepared treatise should prove of great assistance to the student computer, engineer and contractor. It should be instrumental in creating a better understanding of the subject with a result that in the future there will be less friction developed by the settlement of matters dealing with overhaul.

The Atlantic Coast Line is said to have purchased land 2 miles east of Tampa, Fla., which will be used for extension yards.

The Central Vermont, it is reported, has commenced the work of rebuilding its shops at Waterloo, Que.

The Chesapeake & Ohio is said to be making arrangements for rebuilding its shops at Peru, Ind.

The Chicago & Alton will erect 2 freight houses at East St. Louis, Ill. Frame structures will be erected at a cost of $60,000. This road has awarded a contract to Westinghouse, Church, Kerr & Co. for the construction of a machine shop and other buildings at Bloomington, Ill.

The Chicago & North Western, it is reported, has awarded contract for steel for a new shop building at Fortieth avenue to the Kenwood Bridge Co.

The Chicago, Burlington & Quincy has announced that approximately $700,000 will be expended in the construction of a large freight yard at Eola, Ill. Ten tracks will be completed this year, and others will be added later.

The Colorado & Southern will make improvements to its yards near Denver, Colo., at an outlay of about $50,000.

The Erie elevator at Ohio and Louisiana streets, Buffalo, N. Y., owned by the Erie R. R., was practically destroyed by fire on May 15. Other railroad property was also destroyed or damaged.

The Signal Department

ELECTRO-PNEUMATIC INTERLOCKING AT MONTCLAIR, N. J., D. L. & W. R. R.

B. W. Meisel.

The Delaware, Lackawanna and Western R. R. recently installed at Montclair, N. J., a 41-lever electro-pneumatic interlocking machine, of the vertical spring combination type, manufactured by the Union Switch and Signal Co.

Montclair is the western terminal of the Montclair branch, and there are six tracks at the station proper. These converge into two, the east and west bound main lines. The track layout is shown on the track plan herewith. It gives the location of all switch and signal functions controlled by the interlocker. There are 24 levers for 31 single switches, 4 for double slips with movable point frogs, and 15 levers for 33 signals, with 2 spare spaces, making a total of 39 working levers in a 41-lever frame.

There are 3 inbound high signals, with one fixed blade, and one outbound high signal. They are power operated semi-automatic signals, operating from 0° to 60° in the lower right hand quadrant. High signals are mounted on iron signal masts of the ground type, 32 ft. long, with the lower section 6½ ins. diameter, and the upper section 5½ ins. diameter. The remaining signals on the plant are Union Switch and Signal Co.'s standard electro-pneumatic dwarfs, operating from 0° to 60° in the lower right hand quadrant. Of this type of signal there are 15 inbound and 14 outbound.

All signals are electric lighted, each lamp being furnished with two 2 C. P. 116-volt carbon lamps, both burning at the same time. The electrical energy required for lighting the lamps is taken from the alternating current mains. The night color indications are: clear, green; caution, yellow; stop, red.

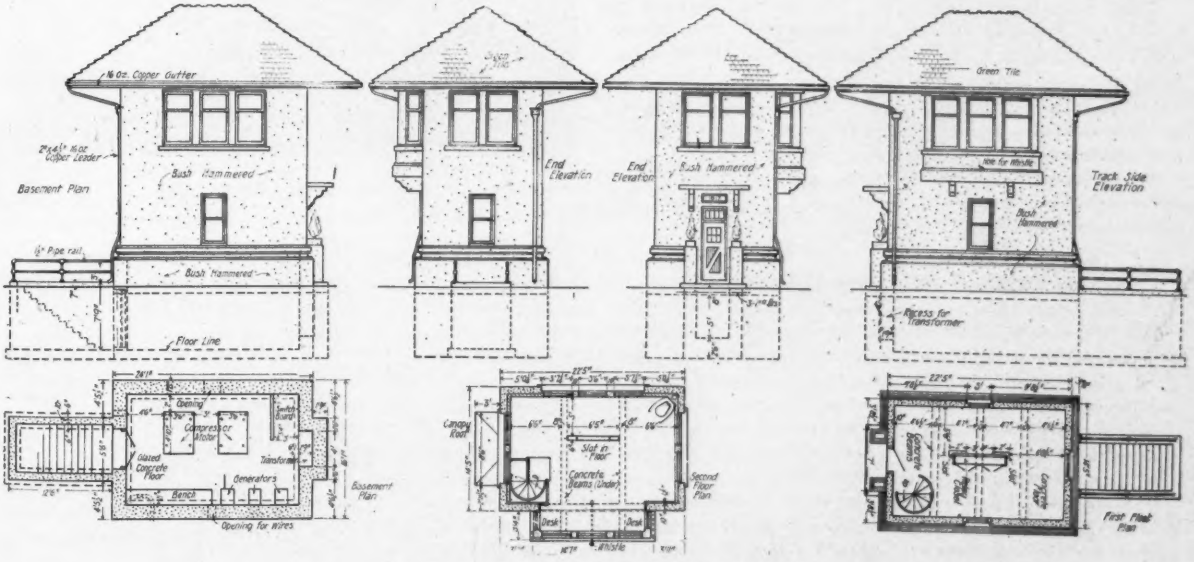
The signal tower is a two-story concrete structure with a basement. The tower plans show the end, the front, and rear elevations, and also the floor plans. The basement plan shows the locations of the power equipment which consists of duplicate air compressors driven separately by three-phase 60 cycle induction motors, rated at 1800 R.P.M. The air compressors are of the four-cylinder two-stage type, each compressor having a capacity of 100 cu.-ft. per minute. The motors are controlled from the switch board with an external starting resistance connected into the rotor circuit.

The motor generator sets, of which there are three, consist of three-phase 60 cycle 220-volt motors with shunt wound generators, rated at 75 amperes and 15 volts. These sets are of the unit frame type and furnish energy for charging storage battery.

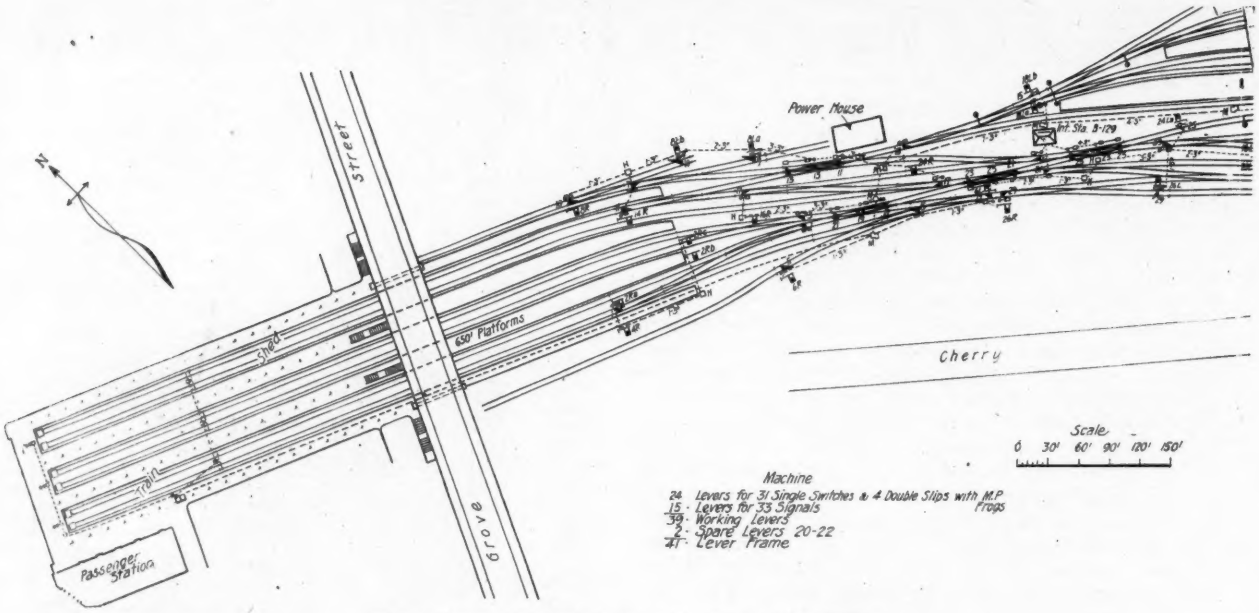
Montclair, N. J., Interlocking Tower, D., L. & W. R. R.*

The storage battery consists of four sets of Edison A-10 cells. Two sets of 16 cells each furnish energy for the interlocking apparatus as follows: for the control of switches, signals, and various indicator and annunciator circuits. One set of battery is for on and one set for off duty. Two sets of four cells each furnish energy for 32 track circuits on the plant.

Photograph furnished by the Kerite Co., New York.



Elevations and Floor Plans, Montclair Tower.



Track Layout, Montclair Interlocking, D., L. & W. R. R.

The design of the switch board and switches controlling the charge and discharge of the storage batteries, is such that when changing from one set to another and vice-versa, the discharge circuit is never interrupted. A five pole double-throw switch is so connected to the two sets of track battery, that in one position of the switch, the cells of one set of battery are connected in series for charge, and the other set connected in multiple for discharge. By reversing the switch, the connections are changed so that the battery that was on charge, the cells of which were connected in series, would be then on discharge, and the cells connected in multiple. The other set of battery would be connected up for charge with its cells in series. The track battery may be charged from any one of the three motor generators, and the main battery from the other two connected in series.

Two No. 6 feed wires are run out through the plant to serve the track circuits. No. 12 wire is used for connections to the individual track circuits with the positive side connected through a resistance unit that may be adjusted to suit the particular track circuit.

Seven of the thirty-two track circuits on the plant have 4 ohm relays, the remainder have 12 ohm relays. The 12 ohm relays are located in the tower relay closet. The 4 ohm relays have 1000 ohm repeaters in the tower.

Approach locking is used on the routes of signals 40-36 and 38. The remaining signals have lock circuits without approach. Sectional route locking is used through the plant.

We are indebted to M. E. Smith, signal engineer of the Delaware, Lackawanna & Western R. R., for the plans and information from which this article was prepared.

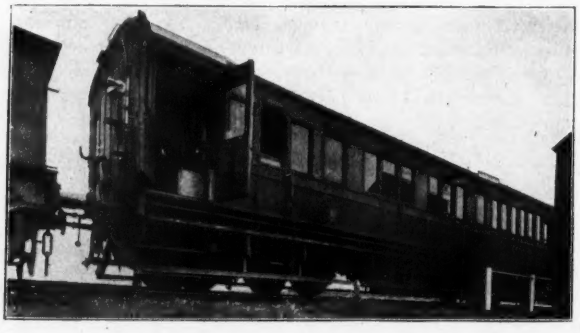
NEW ENGLISH WIRELESS RAILOPHONE.

The accompanying illustration shows the Railophone wireless inductive system of railway telephony, telegraphy and signaling as developed at Birmingham, Eng. There are now well understood principles of electrical intercommunication by means of metallic cable circuits between two fixed stations, and by means of etheral waves between two moving objects such as ships at sea. Both of these systems have reached that perfection necessary for a successful and practical application.

Until recently, however, neither of these principles nor the existing instruments have been applied with any degree of success for the establishment of reliable intercommunication between railway trains in motion or trains and stations.

Surely the isolation of a traveling train deserves serious consideration with a view to placing it in tangible communication throughout the whole of its journey with the outside world and those responsible for its control. On account of the many accidents which have occurred during the past decade, it is urged that not only is this necessary for the benefit of the traveling public, but for the paramount safety of the passengers in these times of ever increasing speed of transport and daily growth of traffic.

In an experimental installation Mr. H. von Kramer, an electrical engineer of Witton, near Birmingham, succeeded in establishing a telephonic link between an express train and a

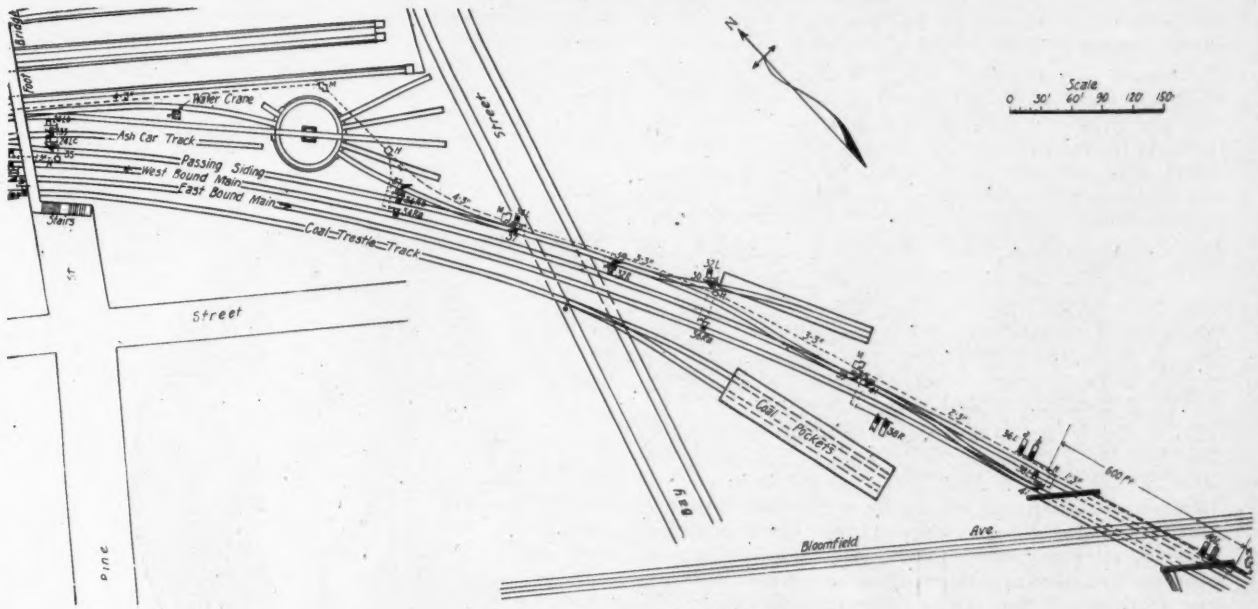


Railophone Installation.

signaling box at Three Bridges station, on the London, Brighton & South Coast Railway. He employed the principle of electric induction between apparatus carried on board the train and a copper cable embedded in the earth several feet away, parallel with but outside of the permanent way.

The apparatus is called "Railophone," and the first installation was made on the Stratford-on-Avon and Midland Junction Ry. (England). The railophone is used as a train telephone. The equipment for the establishment of telephonic communication between a moving train and a station consists of a telephone transmitter and a pair of receivers in the form of an operator's headgear, fixed in a sound-proof telephone box, carried in the guard's van of the train.

These instruments are electrically connected with two large insulated copper coils mounted in a wooden casing, called "the



Continuation From Opposite Page.

railophone frames,'' suspended by iron brackets from the coach. The ''upper frame'' is suitably wound for sending, and the ''lower frame'' for receiving a telephonic message.

A conductor buried along the track is connected to similar telephone instruments fixed at stations, and if desired may be linked up with the general telephone and telegraph system. Telephonic conversation is carried on through the railophone just as through any ordinary telephone, no change-over switch from ''sending'' to ''receiving'' being required.

On the original railophone system there were no means of ''capping up,'' and as is still the case with radio telegraphy on board ship, the railophone operators had to be in constant attendance. It is claimed that this shortcoming has recently been rectified by the introduction of a highly sensitive detector. By the aid of the detector—which corresponds to a ''coherer'' in wireless—the exceedingly feeble electrical impulses received on the train from a vibrating charge sent into the ground wire are picked up and relayed into sufficiently strong currents to ring a calling bell or sound a powerful hooter.

The train telephone enables guard and signalman to communicate with each other—whether the train is in motion or at a standstill—for the purpose of traffic regulation in case of accidents or during fogs or snowstorms, and messages to and from passengers can be ''railophoned'' with ease and accuracy.

The railophone is also used as a train telegraph. With slight modifications to the system as applied for telephony, and by the addition of a few telegraphic instruments, the railophone can transmit telegraphic signals by means of a Morse key. On the Stratford-upon-Avon & Midland Ry. either mode of communication, telephonic or telegraphic, is employed without necessitating the use of change-over switches.

The detector has also been successfully adapted for automatically stopping a train without the intervention of the guard or driver. The Von Kramer system for automatic railophone signaling provides for the automatic blocking of a section against a following train and the liberation of the section after the first train has passed out of the danger zone.

It is also applicable to double automatic railway signaling, for which equipment is as follows: The electrical equipment at the station consists of a signal box fitted with a ''K. K.'' detector, sending, receiving and recording apparatus, and the necessary underground insulated cables laid parallel with the railway lines. These circuits are divided into three distinct groups, viz., the main section (of any suitable length from one mile up to ten miles, and more if desired), the restoring section, and the clearing section, the latter two sections being each approximately 100 yards long.

On the trains the electric equipment consists of two ''railophone frames'' fixed to an ordinary coach, and a series of apparatus for receiving, sending and recording signals. By means of the apparatus provided on the train and in the signal box a certain cycle of operations is carried out.

When a train enters the main section a red lamp is lit in the signals within a fixed period of approximately ten seconds, the main section and until it leaves the restoring section. Simultaneously with the lighting of the red lamp an audible signal in the form of a bell or buzzer sounds in the signal box. These visual and audible signals indicate to the signalman the entry of the train into the main section and warn him of the necessity of protecting it, and unless the signalman responds to these signals within a fixed period of approximately ten seconds, the signal lever is automatically pulled into the ''danger'' position. The automatic operation is simultaneously registered by a recording instrument.

Whether the signal lever has been pulled into the ''danger'' position by the signalman or by automatic means, it remains electrically locked in that position until the train has left the section.

In case the signal lever is automatically replaced, the train is allowed to travel the section, but other apparatus is brought into play, causing a powerful alarm gong to sound outside the signal box, and the incident to be automatically registered on a recording instrument, which indicates the time of the occurrence. By these means a rigid control is kept over the signalman's actions.

Should the signalman operate the signal lever on being warned, nothing further transpires in the signal box until the train enters the clearing section, when the red lamp is automatically extinguished and a green lamp is lit, which is in turn extinguished when the train finally leaves the clearing section, the signal lever being simultaneously unlocked.

After the train has sent out the signals indicating its entry into the main section, it is, by means of a time limit device, enabled to receive signals or instructions affecting its movements whilst in the main section. In this receiving condition the train can at any moment receive either telephonic or telegraphic instructions, can be brought to a standstill by the sig-

nalman at will, or the guard on the train can, if desired, place himself into communication with the signal box.

Under normal conditions a second train, unless it overruns the danger signal at the entrance of the main section, cannot enter the main section if same is still occupied by the first train. In the event, however, of the second train ignoring the danger signal, and entering the section, both trains are automatically brought to a standstill. This incident is also recorded on the train and in the signal box.

If a second train enters the section in the opposite direction to the first train, both are pulled up, thus avoiding the possibility of "head-on" collisions. The train on entering the restoring section automatically receives an impulse which through the "K. K." detector brings into operation apparatus which advises the signalman of the train's entry into the clearing section, by automatically lighting a green lamp in the signal box, and second, on entering the subsequent main section, indicates its approach to the succeeding signal box, reproducing once more the cycle of signals as described.

As soon as the train has left the clearing section the instruments in the signal box are restored to their normal condition, ready to deal with further incoming trains. If the train be prevented from entering the succeeding main section, the green lamp continues to glow, and in addition the alarm gong is sounded outside the signal box, the incident being again recorded.

The railophone signals are "uni-directional" and cannot stray to other trains, as was the case when attempts were made to use the radio-telegraphic principle. There are no sliding brushes required, no mechanical or electrical contact bars or switches under the train, no bonded rail joints, nor any obstructions. The railophone system is not influenced by atmospheric disturbances nor climatic conditions.

It is claimed that the upkeep of the ground wire circuits, owing to their being embedded in the earth, is practically nothing.

The engine does not carry any railophone apparatus whatever, and the driver is not diverted from his usual duties. All the railophone appliances needed to control and protect a train is mounted on a single car.

Personals

J. E. Creviston has been appointed signal inspector of the Erie R. R., at Huntington, Ind., succeeding R. Holland.

R. A. Becker has been appointed supervisor of signals of the Grand Trunk Ry., at Montreal, Que., effective May 1. W. H. Patton has been appointed supervisor of signals at Toronto, Ont.

B. A. Lundy, formerly construction engineer, has been appointed assistant signal engineer of the New York Central & Hudson River R. R., at Albany, N. Y. He entered the service of the New York Central in May, 1896, as clerk in the signal department at New York, and one month later became signal draftsman. He was appointed inspector in August, holding that position till January 1, 1908, when he was reappointed draftsman, at Utica, N. Y., and March 10, 1909, he was appointed wireman at Buffalo. He was made foreman in August, and draftsman at Albany in November. He was again appointed inspector March 15, 1910, at Kingston, N. Y., and on November 1 was appointed circuit engineer. During the early part of 1911 he was assigned to special work in the assistant general manager's office, and on April 15 was appointed assistant engineer in the signal department at Albany, N. Y. On April 1, 1912, he was appointed construction engineer, which position he held till his appointment May 15, 1913, as assistant signal engineer at Albany, N. Y.

W. W. Morrison has been appointed assistant signal engineer of the New York Central & Hudson River R. R., electric division, office at New York, succeeding R. C. Johnson. H. C. Lorenzen, formerly office engineer, has been appointed construction engineer at Albany, N. Y. R. B. Elsworth, formerly assistant signal engineer, has been appointed engineer maintenance of signals, at Albany, N. Y., succeeding L. M. Fitzgerald. J. T. Williams has been appointed signal inspector at Albany, N. Y., succeeding W. H. Stilwell.

F. W. PFLEGLING, Signal Engineer, Union Pacific R. R.

F. W. Pflegling has been appointed signal engineer of the Union Pacific R. R., at Omaha, succeeding J. C. Young, deceased. Mr. Pflegling was born in Terre Haute, Ind., May 27, 1877, educated in the public schools, and after graduating from high school, entered Rose Polytechnic Institute at Terre Haute, taking the electrical engineering course. Between the junior and the senior years, he entered the service of the Chicago & Eastern Illinois Ry.

W. W. MORRISON, Assistant Signal Engineer, New York Central & Hudson River R. R.

as signal repairman. He resumed studies at Rose Polytechnic Institute in the fall of 1900, graduated in June 1901, and was employed successively as draftsman, maintainer, foreman of interlocking, signal foreman and general foreman on the Union Pacific R. R. January 1, 1903, he was appointed signal supervisor with headquarters at Cheyenne, Wyo., and in February, 1912, was transferred to Kansas City, Mo., in a like capacity. He held the latter position until June 1, 1913, the date of his appointment as signal engineer.

G. A. Ziehlke has been appointed supervisor of signals of the Union Pacific R. R. at Kansas City, Mo., succeeding F. W. Pflegling, promoted.

The Maintenance of Way Department

Maintenance Methods.

DUE POSSIBLY more to necessity than to choice, two methods of handling maintenance work have come into common use. One we may designate as maintenance wholly by regular section crews, the other as maintenance by section crews assisted occasionally by extra gangs.

The reason for using extra gangs in regular maintenance work, is on account of maintenance being allowed to run down due to one of several causes, or a combination of them. Frequently section labor becomes scarce and the foremen are unable to obtain sufficient men to do the work. Incompetency is another one of these causes. The third, and one frequently found especially on railways located in the central, southern, and western states, is the practice of limiting expenditure in slack seasons in order to keep net profits up to standard.

We would like to obtain the opinions of practical track men on this subject: "Maintenance work entirely by regular section forces, compared with maintenance work by section forces aided occasionally by extra gangs."

The following topics are suggested:

Do you favor making section gangs large enough to handle all regular maintenance work?

Do you favor combining section crews for renewal work in relaying, etc.?

Are extra gangs as efficient as section gangs, as a whole?

Do you find work done by extra gangs stands up well, or is it frequently so inefficient as to be uneconomical?

Is more difficulty experienced in obtaining, working, and keeping extra gang laborers?

Should section gangs be made large enough to do reballasting?

How are extra gang foremen obtained?

Are your section foremen as a rule capable of handling larger gangs in reballasting and relaying?

State advantages and disadvantages of each method.

Many times the method in which maintenance work must be carried on is specified; but concerted condemnation of cheap first cost but ultimate high cost methods, cannot help but impress those officials who are responsible for the policy adopted. Contributions published on the above subject will be paid for at regular space rates. Illustrations of the effects of different methods of maintenance should be included, if of interest in connection with an article submitted, and will also be paid for.

Address all contributions to Editor *Railway Engineering*, 431 S. Dearborn St., Chicago.

Joint Plates.

TWO SUGGESTIONS which would be radical departures from present practice were made in a recent issue of the *Maintenance of Way Bulletin*. The first suggestion was that the joint or base plate be eliminated, and there are, indeed, some strong arguments for such a policy.

The reasons stated in the article in question are that it is of little real help in holding up the joint. The support to the rail, it would seem, is inconsiderable; the force required to bend a plate only ¾ in. thick (and this thickness refers only to the ridge on each side) is not very great; compared with the resistance of the rails and angle bars, it is practically negligible. When, however, the base plate is made a part of the angle bars, it produces a very appreciable stiffening because the steel in the entire plate must stretch or give before the joint will lower. In other words, its bending moment is greatly increased, because it is several inches farther from the neutral axis, or point at which no bending occurs. The neutral axis in the latter case is above the flange of the rail, while in the former case it is somewhere near the middle of the base plate. Everyone is familiar with the fact that two 1x4 in. boards laying flat, one on top the other and free to slide, will not support as big a load as a 2x4 in. piece on its side. The same principle will hold true in the case of the separate base plate.

It is undoubtedly apparent to all who have gone into the question that the supporting power of the base plate is hardly sufficient to justify its use.

Probably the main reason for the use of base plates is to hold the joints to gage more securely. But when track creeps it usually throws the joints tight, because nearly always one rail moves faster than the other. The creeping tendency will cause tight joints on either square or broken jointed track, but on broken jointed track ties may be moved over and the gage readjusted without pulling spikes.

When relaying the use of joint plates causes considerable difficulty and added expense. The old joint ties are always low there is danger of bent rails. The lowering of ties under new joints is not so serious, since it is quite customary to put in part or all new joint ties to make the joints safe; also, it is generally necessary to move the tie clear off its old bed, and since the track is usually gone over by a surfacing gang after relaying, the last objection is not so serious.

The cost of pulling spikes is very high when joint plates are used, as the track when creeping cuts the spikes and wedges them tightly. It is many times impossible to pull the spike, the head breaking off, after which the stub has to be driven down into the tie with a punch.

The use of a combination base plate and angle bar will decrease, but not entirely do away with binding and spike cutting at the joint. The joint has been conceded to be the weak point in the tracks, and yet it is expected to take care of both vertical loads and longitudinal pressure, both of which are often excessive.

Experiments have been made with tracks by entirely anchoring the rails on other than joint ties, leaving the latter to take care of wheel loads only. This, it would seem, is a step in the right direction. The use of a broader tie at joints than in the remainder of the track would also appear advisable in these times of increasing wheel loads and greater speeds.

The second suggestion referred to was to design rails with a much wider base, the base also to be a fraction wider on the outside than the inside. The increased bearing would, it is stated, do away with the necessity for tie plates. Thus creeping would be checked by the greater friction between steel rail and wooden tie, and it is suggested that this friction be increased by diamond points or corrugations on the rail bases.

In the latter case the rail would have to be seated by traffic, which, it would seem, is open to the same objections as seating plates in that way—sand and ballast get under and prevent the plate from being properly seated.

RECENT WASHOUT IN INDIANA.

By Warren Peachey, Supervisor.

On March 24 we had an exceedingly heavy rain, probably the heaviest that was ever known in this region, and on March 27 water cut out 1,500 feet of the embankment in White River bottom. We had to drive a 112 foot trestle to span this break, driving the piles in water which was from 5 to 35 feet deep. We used two pile drivers on this job, working towards each other from opposite sides of the break. The trestle was ready for traffic in 17 days, although, as is shown in one of the illustrations, the water was still very deep when the work was finished. Minor breakdowns delayed us possibly half a day during this time. The embankment which was washed out was about 12 feet high.

In order to discover evidences of weakness, we had our men out patrolling the dump all the time track was threatened; these men had special instructions to keep a sharp lookout for holes through the bank caused by ground hogs, and whenever a weak place was discovered we hurried men and bags of sand to the ground and reinforced the fill at that point.

The reports from the head of White River, both the East and West forks, were closely watched and indicated that we were to have very high water, and the reports were more than justified, the water attaining a height of 2 feet greater than ever before recorded.

It was impossible to strengthen the embankment in the short time at our disposal to successfully withstand the deluge. The photographs will show the impossibility of successfully combating a volume of water of such magnitude. Water was seven feet higher on the upper side of the embankment than on the lower.

The fill is in a bend of the river, about seven miles around, while it is only one-half mile across the bottom on which the embankment is. When the water got high it took the short course, because the fall was proportionately sharper—fourteen times as great, to be exact. A washout occurred at the same place sixteen years ago, and was repaired in a manner thought to be permanent.

Bags of sand were made use of to try and hold the embankment and track, but these did not avail against the flood.

A half mile of track in the Wabash bottom was washed off the grade and against the right-of-way fence. The ballast was washed out for two miles, and the grade was cut full of holes.

Cars Standing on Trestle to Prevent It Washing Out.

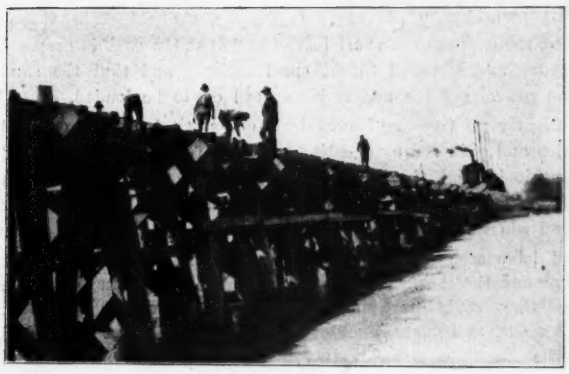
My method for getting track back on the grade was by use of ropes. We had three, each about 100 feet long, and tied these to the rails about twenty feet apart. We assigned twenty

Sand Bags Protecting Bank at Bridge End.

men to each rope, and had in addition fifty men with lining bars to help line the track back. We put the one-half mile of track back on the grade with that method in twenty-four hours with a force of only 125 men.

In another place there was a hole 150 feet long cut in the grade, about fifteen feet deep, the track left swinging in the water. We repaired this by building piers of sand bags, running stringers out and putting them under the rails. Then

Bags of Sand Protecting Bank. Note Depth of Water on Telegraph Poles.



Temporary Trestle, Ready for Traffic.

Track Washed Out; Part of Dump Shows 700 Feet to South.

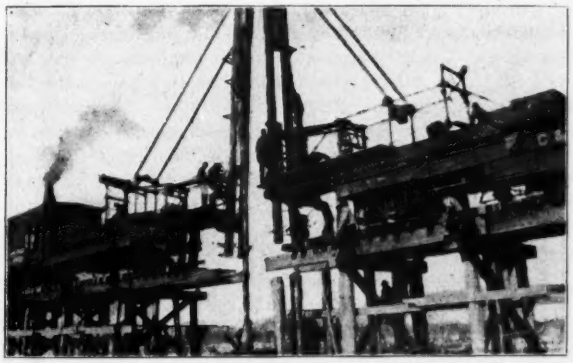
cars were shoved out on this improvised bridge and coal slag and stone was unloaded to fill up the hole. We had no pile-driver which we could get to this place, or the hole could have been repaired by a temporary trestle.

Several bridge approaches were washed out, and we repaired these by using stringers from the first bent back to a mud sill in the end of the bank. This allowed us to get across with a light work train, and then the approaches were filled in.

RAIL RAVELINGS.

Dear Dad:

In your last letter you said something about the time I arrived on a new line ready to start work just after a washout had carried away 5 miles of track. The first day on that work



Two Pile Drivers Driving Last Bents.

vindicated your slogan of "organization first." You always held that organization was more important than anything else—even more important than good men, good methods, or good foremen.

The general foreman in charge of the work was not in town, so the engineer instructed me to go out next morning and start getting the track back on the grade. It had lodged against the fence, none being farther than about 50 ft. from the grade. The embankments were of "gumbo," which, as you know, once settled, is very hard, and in most cases successfully resisted the water, although the track and ballast were washed out.

We were carried out by the work train to the place where track was off the grade (we had one gang of about 15 hobos and one of 32 Macedonians), and there we met two section gangs of 15 men each. There were then on the job 1 hobo foreman, 1 hobo assistant, 2 section foremen, myself and assistant foreman. I had understood that the work was to be in my charge, but found that such was not the understanding of the section foremen or of the others—in fact, the instructions had been generally by word of mouth to "work together." Every man had a different idea. Neither section foreman had ever worked a big gang, and I soon discovered they had never lined a track over for any distance. It was impossible to convince them that they should line the track over in the same direction each time, working toward the end having greatest expansion. They insisted on lining up and then back, also trying to line over an excessive distance with each move. As you know, that results in a good deal of wasted time and energy attempting to get the last inch. After finding out the way matters stood, I decided that I could earn my money just as well setting on a nail keg, so I did that very thing. The gang worked all day long on 600 ft. of track which had swung out; and when they got it on the grade they had a beautiful double kink right in

Showing Difference of Water Level Above and Below Bridge.

the middle, and they worked for an hour trying to get it out.

All this wasted work could have been saved by "giving definite orders in writing."

On my report that night I showed "600 ft. of track put on grade." The engineer asked me why so little was done, and I answered in three words—"Too many bosses." And since then I have found that same trouble in a lot of places.

The next day I carried copies of telegrams in my pocket and a note advising each foreman that the work was under my direction. Probably the reason for doing this was that it was realized that "any head is better than no head at all."

A few clashes followed, but I insisted on carrying out instructions to the letter, so far as possible, and in this way always had the support of my superiors. On one occasion an old hobo foreman 30 years my senior insisted on lining track his way, contrary to specific orders given me. I told him why I was insisting on my way, and then he said he would quit, take a lining bar and work with the men. I immediately took hold of the gang and told him to do as he pleased, and after standing around for a few minutes he changed his mind and said he

would do as told, "although he knew it was wrong." And we had no further trouble.

It is of great importance in throwing track onto a grade after a washout to collect men and work in large gangs. A gang of 15 to 40 men will be nearly helpless; 40 men will accomplish probably one-tenth as much as 100 men. The gang should be large enough to "pick up the track and carry it away."

To sum up, my experience in that washout showed: (1) Special necessity for strong organization and for placing the entire force definitely under direction of one man; (2) advisability of giving written orders to all concerned; (3) value of large gangs for putting washed-out track on the grade.

There are other things which should not be forgotten. In lining any track a long distance it should always be lined in one direction. Start from one end and line to the other, walk the gang back and repeat. The time lost in walking is really a saving, because the track will not kink and will be easy to get in shape when in final position. Also, it is advisable to line track at each throw, only so long as it moves considerably, say at least 6 ins., each time the men pull on the bars.

PIECE WORK FOR RELAYING.

E. Butcher, Roadmaster.

I have never used piece work in track construction or maintenance, but in laying steel I often work on the same principle, that is, laying so many track feet of steel for a day's work. I don't believe that piece work could be worked to any advantage in maintenance of track as there is a great deal of difference in labor performed in maintenance work, and condition of road bed and amount of ballast would have a great deal to do with putting in ties unless you were surfacing track.

For instance, where track was very light ballasted you could put in ties at least three cents per tie cheaper than where track was full ballasted; and where there would be from two to four ties to be taken out in one space they could be put in cheaper than where there is only one tie in a place to come out.

In cleansing cuts, that is, cleaning weeds from track especially in this country, Johnson grass is very heavy in certain locations and would make a difference in piece work in cleaning track, as where Johnson grass is heavy on shoulder, it will cost four times the amount to clean the same number of feet of track as where there is none.

In regard to laying steel, it would be very difficult to use piece work on renewal of steel, on account of the number of trains. Take, for instance, where there is business which requires extra trains. The more trains you have to contend with during the ten hours, the more it will cost to lay steel. The only place where I believe piece work could be handled to any advantage is in construction of new lines.

PIECE WORK VS. DAY LABOR.

By O. A. McCombs, Roadmaster.

There is a difference between piece work and contract work. By piece work we mean work that can be done by one or two men, each receiving pay at a stated price per piece.

Contract work is work done under an agreement, the contractor agreeing to do a certain piece of work, or have it done, for an agreed price. He can do the work himself or hire it done.

It appears to me that we are gradually drifting from day labor in track work to piece work or contract work, wherever practicable to do so. Any time there is a piece of work to do, such as concreting for buildings, bridges, culverts, foundations, etc., it is done by contract if we can get a reasonable bid. Loading gravel, rock and sand for ballast and for concrete work is nearly always paid for by the yard. Such work was formerly done by day labor, but we find it more satisfactory to all to do it by piece work or contract.

It is necessary of course to keep a sharp lookout to see that the cars are not short loaded and that the rock is properly broken and screened to the specifications; and that the sand and gravel are the materials agreed on to be loaded.

Nearly all ties are loaded by piece work from the original piles and paid for by the tie; and it is best for all concerned that it is done that way. The men make more wages when paid by the tie, and the company gets the ties loaded cheaper than when loading by day labor.

I have seen men loading ties by day labor in the summer time and the thermometer from 95 to 105 degrees in the shade, and they would drag along until nearly the whole gang would play out, and there would be very little done. The method of loading ties was for two men to stand at the pile and hoist the ties onto the shoulders of two other men, who would bring the ties into the cars. The very same men put on piece work, under the same conditions, would bring those ties right along into the cars. Under day labor two men could hardly carry one tie. Under piece work "one man, one tie" was the rule and not the exception. Of course some of the men could not keep up with this new order of things and the weakest ones were soon thinned out and the work went on satisfactorily.

Ties are sometimes distributed by piece work along the track, but this has not been as satisfactory as in loading. When distributing ties the men unloading by pieec work, in their haste, will unload ties where they are not needed. If a few ties only are needed at a certain place, and the train stops to unload, they will throw off more than you need, necessitating a great deal of unnecessary handling with a push car. And in addition the men have to be watched closely to make them keep the tie clear of the track. In one instance that I have in mind we had to send a regular section gang behind the unloading train to move the ties clear of the track. This was partly due to carelessness of the unloading foreman and a difference of opinion between the unloading foreman and the roadmaster, who came along shortly after they were unloaded. The unloading foreman thought the ties would clear trains but the roadmaster thought they were too close to the track, and, not caring to take any chances of the ties being struck by a passing train, he had the section men move the ties back to clear. Of course the labor of moving the ties back to clear the track could have been charged to the unloading gang, but it was not done in this case.

Where there is a great deal of rail drilling to be done it can be done satisfactorily by piece work. On a certain job of track construction, where there was a large amount of drilling to be done for bonding rails, and to attach signal appliances to rails, the men drilling were getting along slowly by day labor. It was decided to try piece work, and the men drilled about twice the number of holes in a given time on piece work as they had done at day labor. The men made more wages and the work was done more cheaply and quickly. On this particular job the men took better care of the drills and bits, and the drills were not in the shop for repairs as often as they had been when being operated by day labor. This work required the presence of a foreman to see that the work was properly done. There were no disadvantages in this instance; it was better than day labor for all concerned.

A fire guard is often cut along the outer edge of the right of way by piece work, with a team and mower where it is practicable to do so, a certain price per mile being paid. This is more satisfactory to all concerned than to do it by the day as was the custom heretofore. These guards are cut while the grass is green, and the grass that is cut is burned as soon as dry enough. This makes a good fire guard and prevents fire from spreading from right of way to adjacent meadows and farms. This work does not require the presence of a company foreman while being done. After the work is done it is inspected and paid for if done as agreed upon.

I have enumerated above some of the things that are being done by piece work to advantage on the track. The writer believes there is other work on the track that is now done by day labor that might be done to advantage by piece work. I think it would materially decrease the cost of some of the work to do it in that way.

Putting in ties, for instance, where the ties are already distributed just where they are to be put in, and the track is the same kind of material for long stretches. Two men working together could put in ties to advantage and be paid by the tie. And I think they would do the work just as well and more cheaply. Putting a tie in by piece work would consist of taking out the old tie, putting in the new tie, putting tie plates on the new tie if there were any on the old tie, spiking the tie and tamping it, and filling track as it was before it was disturbed.

A man putting in ties by piece work should not be expected to raise joints, surface or line track. But he should keep it in as good surface and line as it was when he commenced to put in ties. Of course if the men could, by raising a low place, get ties in more easily, they should be permitted to do so, as it would leave the track in better shape.

In cutting grass and weeds and cleaning off the track, where there are miles and miles of track that are very much alike, each rail needs just about the same amount of work. In doing this kind of work now under day labor it is best to put a man to a rail length, or better still, two men to a rail length, and let them clean it off. It is best not to assign too large a piece of work in one place under day labor, when working in a gang, as the men like to skip ahead frequently. I have noticed the men take more interest in the work when done this way and do more work than when working along in a chaotic bunch just working here and there and anywhere in the gang. When a man gets to lagging behind on a job like this, the other men call on him to do his part and keep up with the gang. Even the laborers in a gang like to see every man do his part on a job of work.

Now it appears to me that a job of weeding as described above might be done by piece work more cheaply and with more justice to the men. Good men would make better wages and the worthless men would be thinned out or only paid for the amount of work they did.

I was on a job of work at one time where the ties had been put in too thin. Under a new management the ties in this piece of track were to be spaced closer and two more ties put under each rail. This work was done by day labor. The track had been laid with broken joints. The ties were distributed along the track just where they were to be put in and each man was assigned a half rail length, to space the ties, put in one tie, tamp and fill the track. When a man was ready to spike his tie, the nearest man nipped the tie while he spiked it, then he in return nipped the other man's tie when he was ready to spike his tie. Each man, of course, saw that he was expected to do as much as the other men in the gang, and there was much more accomplished than by working in mass on a job like this. This work might have been done by piece work as there was mile after mile of track that needed the same amount of work.

I do not think we could do all track work by piece work. We could not get along without the regular section gang. There are too many unknown quantities about track work to do it all by piece work or contract. There is a great deal of maintenance work that must be done by day labor.

For example, a certain piece of work will obstruct the track about one hour and the only time available between trains is from 2:50 to 3:50 p. m.. The dispatcher says the 2:50 p. m. train is on time. Everything is made ready to tear out as soon as the 2:50 p. m. train passes, and it is necessary to get the work in for the 3:50 p. m. train. The 2:50 p. m. train is delayed till 3:20 p. m., thirty minutes late. It is too late then to put the work in as passenger trains are quite thick after that until late at night. A man could not afford to wait on trains, to any great extent, if doing contract or piece work. A regular gang could go at some other work while a contractor or piece work man might not have anything else to do in that vicinity. And if the trains were delayed it would be unsatisfactory to the railways, and there is quite a penalty for running passenger trains late in some states, without a valid excuse. I do not think a job like this, under like circumstances, could be done by piece work or contract work to advantage. The track must be regularly inspected, and emergency jobs here and there must be done by a regular force, regardless of cost.

I think we cannot make piece work out of raising joints, raising low places here and there, lining track, tightening bolts (track, frog and crossing bolts), gauging track in weak spots, changing broken angle bars, changing broken frogs, etc. There seem to be a thousand and one little jobs about track maintenance that will have to be done by day labor in a regular section gang. I do not think piece work feasible where a number of men are required to do something like distributing rails along the track, handling heavy timbers, working at wrecks, etc. It would be difficult to pro rate the pay among the men, and the men could not agree about the work among themselves.

The advantages of piece work when it can be applied are: (1) it reduces the cost of doing the work, and (2) an industrious laborer can make higher wages. Of course the idlers and drones among laborers would protest against piece work as they do not like to see anything introduced that would make them do their part. They would like to work on in the same old way, dawdling and idling along for a daily wage.

We want actual facts and not theories about piece work. We want the actual facts after a thorough tryout as to the practicability of doing part of the track work by piece work. But who will try this innovation in track work? People who are in a position to give this matter a trial, and are working for a corporation, do not like to take the initiative in suggesting methods out of the ordinary. A great many men never do anything except they were taught to do it; they do not seem to realize that they might improve in a great many things.

If we can get piece work on part of the track work and a bonus for the good men on day labor I think it would be a step toward obtaining a better grade of track laborers. If we try some new way of performing things, and it falls below expectations through some outside influence, we are censured for a waste of time and money. If it exceeds expectations and there is a saving of time and money, nothing is said.

We do not often get praise for the good things we do, but we often get censured for the things we left undone. This tendency does not promote efficiency in track work.

LABOR ARTICLES.

Editor Railway Engineering:

I have noticed a good many letters from supervisors in your paper on the labor subject.

In this part of the country we use Italians, and it is very hard to get laborers on account of the way they are treated. The company increases the force about April 1 each year. Possibly in two or three weeks they will give orders to lay off one man and work the others only 8 or 9 hours per day. Such tactics discourage or disgust good laborers.

Foreman should be notified that a certain increase is to be allowed in the forces, and they should be told when they hire men just how long they are to be kept, and how many hours they are to be worked each day. The company would be benefited by working the full 10 hours for 9 months of the year, and 9 hours for the remaining 3 months.

The track department is the most essential department on a railway, in my mind, because without track laborers and foremen, rolling stock could not be moved over the road.

Track laborer's wages should be increased so they could live respectable lives, and not like tramps.

Track laborers should not be compelled to pump their cars over the section, to and from work, and then work all day; their energy can be used to better advantage than in pumping handcars.

If the railway will have a defined policy and stick to it, and tell the foremen about it, the latter will take more interest in their work. A great deal of responsibility is placed on the foremen, much more than on the train crews, but the latter get far better wages. The foremen should be paid more wages; but in spite of their responsibilities, they are underpaid and the railways figure they can easily fill their places if they quit. The section foreman, as well as the laborer, is not being given a square deal. Section Foreman.

LABOR CONDITION IN THE WEST.

J. P. Haddix.

I have worked gangs of from 125 men down to section gangs and have work gangs of Greeks, Mexicans, Japs, Italians, Bulgarians, Swedes, Austrians and Americans, as well as mixed gangs, and have found it impossible to have a method that will apply to all gangs. It is impossible to treat every man the same, as we have men of most every character and disposition. To try to get work out of a man that has no self-respect by kind treatment is almost impossible.

Handling a gang of men requires considerable study of human nature. A foreman, after some experience along this line, can almost read a man's disposition at first sight and tell what part of the work he would be best adapted to. A method I have found that worked well was to treat men in a general business-like way, never getting too intimate with them, showing them how to take advantage of all the work, and the reason for doing the work the way that I insist on. If a man doesn't know the philosophy of the work he does, he is not likely to do it well.

In most all gangs there are a few men who are a great deal better workers than others, and who are willing to do a fair day's work. I make it a point to flatter such men on their work and point out to them the poor methods and work done by the poorer workers. In a short time the good men will help greatly to train the poorer workers. Where possible I work the men so that each one will do the same amount. In tamping and putting in ties, filling in and dressing up the ballast, I have a piece of marking crayon, and in case I think a man is slighting his work I quietly chalk mark the place, and when he has finished I examine it and call his attention to any defects. The next time the man does the same thing I get pretty rough on him, and I have the good men on my side. Thus, I can discharge the poor worker without offending the good men, as they know that if a man does the work right he will be treated right.

A few poor workers can ruin the work of a whole gang. It may not show up at once, but in time the most of the work will have to be done over. When I have a good man, and I need some special job done, I pick this man to do it, and when he finds I place confidence in him he will appreciate it and try and do an extra good day's work.

Since some men are good at certain kinds of work, I make specialists out of them, and I find it helps to get work out of them. And when they have done the work I never forget to flatter them if it is done right.

A foreman must have absolute control of a gang of men and lots of self-confidence, for if a foreman has not confidence in himself the men soon learn this and they lose confidence in him and then he soon loses control of them. If he has some work he does not exactly understand he had better run a bluff that he does and keep the confidence of his men.

Our company gets labor from Chicago and Kansas City for extra gangs. Men are furnished outfit cars, which are fitted up with bunks and stoves. For section gangs we have some American and some foreign labor. The latter are supplied with boxcar bodies with the trucks removed. The wages paid range from 15 cents to 16 cents per hour, with time and a half for overtime.

The trouble with most of the foreign laborers is they do not eat food enough to generate strength to do a good day's work. I have seen many with only a piece of dry bread for a meal. A man cannot do a good day's work unless he is fed well. I think the companies should run boarding cars and compel men to eat three good meals per day, and they would profit by it, for most foreign laborers do not intend to become citizens of the United States and are only over here to make a stake. This takes them about three to five years by starving themselves and doing as little work as possible. These men do not try to learn a profession and have nothing in view except a "stake."

I think that at about $2 per day we could get pretty good laborers on sections, who would spend all the money paid to them for a living and to build homes, and they would consume the products of the country in which they are employed.

Modern tools and motor cars to go to and from work, etc., I think, would also have a tendency to attract good laborers. Motor cars are much faster than handcars, The time saved will soon pay for the motor car.

Education, I think, has caused the lack of track labor. Nowadays when a young man gets an education he thinks he ought to start in as president of some company.

Our section foreman receives $65 per month, with overtime, which runs from $5 to $15 per month, amounting to about $850 per year. A professor of a village school gets $80 per month for nine months, amounting to $720 per year. So it is easy to see a foreman has not such a bad position.

The trouble with track work is that it is underestimated compared with other skilled work.

A few years ago, when we had the Americans or Irish and German extra gang labor, this company furnished a foreman with an assistant foreman and a timekeeper. A foreman could pick out a few of those men and send them to do most any kind of track work. He could stay on the main part of his work with the most of his men, and in this way he could accomplish a good day's work with the gang.

Nowadays, with the foreign labor, a foreman is furnished an interpreter, who cannot do any part of the work, and whose only interest is for the men, who pay him $1 or more per month per man to look after their interests. He also runs a commissary car, which brings him in good money and, in fact, he draws as much money per month as the roadmaster, or even the superintendent.

Many times laborers steal away from the work, unnoticed. The way to overcome these conditions is to furnish a timekeeper to check material used and amount of work done. Even then some men will steal away while the foreman is busy looking after important work. I have made a practice of checking men several times each day, never at the same hour, in order to keep such men on the work.

A foreman is not in very good condition to set down and do two or three hours' office work after ten hours looking after a gang of this kind.

These men ship out on a contract, saying if a disagreement between them and the foreman arises that the roadmaster should decide whether they should be discharged or not. I have worked for roadmasters that would not up-

hold me, and I could do nothing with a gang. This is evidence that a foreman should have the right to discharge a man if he did not do his duty. The men soon find out that a foreman can't discharge them, and when he is all alone the roadmaster has only his word for the conduct of the men, as they generally will be working well when the roadmaster comes along.

Quite often a foreman will take six or eight men to do a job of lining and will have to leave the largest part of his men. In these instances an assistant would save many times his wages in a month.

I had charge of a construction gang one year for a contractor, and the company we were doing the work for had an inspector on the work. I did all the raising myself, and I was furnished two or three assistants. And the large amount of good work we could accomplish would surprise you.

For section laborers with families, house rent is too high for the wages paid.

I think the company should furnish living quarters for section men. Old condemned boxcars could be fitted up (say two 40-ft. cars), and these would make plenty of room for a small family. A man with a family is steadier and would stay in the employ of the company.

Most all companies have right-of-way, which could be used as gardens, and laborers could raise all vegetables for their own use. These gardens would also keep down weeds.

These methods would help to cultivate and maintain between the company and employes a spirit of mutual interest.

One of the greatest menaces to the prosperity of railroads is adverse legislation, and for this reason every employe should be a citizen and vote against any politician that is not of a disposition to do the right thing.

A few good loyal section employes at each station would help greatly to stop this adverse legislation.

Work should be arranged so that jobs of some kind, such as adzing, etc., could be done in winter to give winter employment to section laborers.

Companies should operate their own boarding cars and let men have board for the actual cost of same. Boarding cars operated by private parties are not, as a general thing, very satisfactory.

SCRAP FROM THE MAINTENANCE OF WAY DEPARTMENT POINT OF VIEW.

J. T. Bowser.

The amount of capital which may be tied up in a useless and unsightly accumulation of scrap, the loss by theft, the deterioration of scrap improperly cared for, the danger to employes and others from scrap scattered along and between tracks, makes the handling thereof a matter of importance which requires the close attention of all maintenance of way officials.

In the system for the collection, classification and sale of scrap, lies the saving or loss effected thereon. The following suggestions may be of value to those interested.

For the collection of scrap of all kinds from along the line of road, a good practice is to have section forces accumulate such scrap as they can handle at various points where it can be loaded to advantage. If section forces are required to bring in each night to such points the scrap which may have accumulated on that portion of the line over which they pass, this collection may be effected without any appreciable interference with regular work. This arrangement put into effect, a regular day should be set on which scrap is to be loaded in each month, and a car should be placed on local freights for this purpose. Section forces should be instructed to meet the local freights at the points at which scrap has been accumulated and local conductors should be instructed to be on the lookout for these forces and make the necessary stops. On very busy railroads, this of course may not be practicable, and resort may then be made to the slower and more expensive plan of billing cars from one station to another or picking scrap up with work trains. Scrap cars should be billed to stations where scrap yards are maintained so that proper classification may be made.

Scrap in yards and terminals especially, should be kept picked up clean on account of the danger to employes and others from falling over it. This scrap should be loaded as it accumulates, in car load lots, and forwarded to classification yards.

At accidents, a great deal of time may be saved by having as much of the scrap as possible loaded while the derrick is on the scene. After the track is clear, section forces may often get such scrap in shape to load while the derrick is on the side track for passing trains. It has often been noticed that on some supervisors' districts it is seldom necessary to send the relief outfit back to the scene of an accident to pick up scrap which had to be prepared for loading. They had it prepared while the relief outfit was there.

If general classification yards are maintained where maintenance of way scrap is handled in connection with car, engine and other scrap, the responsibility of the maintenance of way official ends there. But if, as is often the case, maintenance of way scrap is handled separately, proper facilities must be provided for unloading, classifying and reloading.

If the amount of scrap to be handled does not justify the expense of special track facilities, a location should be selected on a track on which cars loading and unloading would not be disturbed to a great extent.

On this site, classification bins should be constructed for small scrap and platforms for the heavier material. The bins and platforms may be constructed economically of old car sills or bridge timbers. Such bins or platforms should be constructed flat on the ground or on mud sills, the ground having been graded so as to place the floor of such structures at about the height of the average car floor. Bins and platforms may be constructed on bents or other foundation if the expense of grading to the proper height is prohibitory, but in general the expense of constructing and maintaining foundations capable of carrying the load to which they would be subjected, will justify the grading up suggested.

In cases where the amount of scrap to be handled is not large, it can be handled to best advantage by section forces but where a large amount is to be handled a special gang should be assigned to the handling.

Scrap yards are often located at or near shops from which compressed air or steam may be obtained and in such cases power hoists may prove profitable investments for the handling of the larger material.

On the arrival of a scrap car from the line of road, the maintenance of way scrap should be separated so far as practicable from the car or engine scrap, and each class should be placed in the proper bin as unloaded. Unclassified or improperly classified scrap brings a much lower price than that which is properly classified. Maintenance of way scrap may be classified as follows:

Iron Scrap.

Iron rail, three feet and over. (State section.)

No. 1 wrought (bars, rods, pins and bolts 6 inches and over long, frog and crossing fillings, frog plates, hand and push car axles).

No. 2 wrought (bolts and rods under 6 inches long, track spikes, lag screws, rivets, nuts, beams and channels).

No. 1 cast (cast bridge and track scrap not over 300 lbs. per piece).

Steel Scrap.

Steel rail (6 ft. and over in length, free from frog, switch, guard rail or crossing pieces).

Steel rail (under 6 ft. in length, free from frog, switch, guard rail or crossing pieces).

Steel splices (plain and angle).

Steel castings.

A great deal of good second hand material is loaded with scrap material picked up along the line, and when this material is being classified, care should be taken to lay such material aside to be returned to the store room or to the shop if repairs are needed. Uninjured parts of frogs, switches, switch stands, etc., may often be found which may be used to advantage in the store room or shop. Old frogs should be carefully examined as it is often the case that rebolting, reriveting, a wing rail or a spring may make one fit for further service.

Scrap frogs will bring better prices when cut apart and after being cut apart the various parts should be placed in the bins according to class. If a frog shop is maintained, fillers, springs and other uninjured parts should be sent thereto for use.

Regular reports of the amounts of the various classes of scrap on hand should be made by the employe in charge of the handling of such material, and such reports should be transmitted by the maintenance of way official, to the department head, or to the official who handles the sale of scrap, so that he may be advised of the scrap on hand available for sale.

Sale being effected, a sale order should be given the division official, in which should be stated the quantity sold, the price and shipping directions. Cars for loading such shipments should be weighed light and the new light weight stenciled on them. This will often save shortage claims. A minimum car load of say twenty tons should be established on account of the advantage to be gained in freight rates. If two classes of scrap are on hand which combined will make a car load and they can be disposed of to the same party, they can often be loaded in separate ends of the same car. In such cases the car should be weighed after loading the first class and again after loading the second so as to obtain the correct weight of both classes. Bills of lading should be furnished the office in which the invoices are made and the gross and light weights should be shown thereon.

As a general practice, scrap sales should be made f. o. b. selling company's line, and should be billed to the order of the purchaser, bill of lading to be delivered on payment of the invoice. This will simplify collection and will avoid loss through slow or non-payment.

REPAIRING WASHOUTS.

T. E. Casteel, Roadmaster.

Where a weak place is discovered which is in danger of washing out, it should be rip-rapped on the lower side, making a five-foot shoulder out of rock, the out edge of the shoulder level with the top of rail. Ballast the track with crushed stone and make a 48 inch shoulder, measuring from rail to sub grade on the upper side.

The dump always begins to cut out on the lower side where the water runs over the track and having the wall as high as the rail on the out edge will leave dead water along the rail so the current will not be so strong. The track should have several openings so the water can get away quickly.

I have noticed several places where culverts are put in and a channel cut from one ravine to another making one culvert do for both places. I think this is a bad mistake as the ditch gets filled up and makes a pond for the water to soak into the dump, making it soft. If a culvert is provided in all of these places, the water can get away, the road bed will dry out more quickly and the track will hold better.

One method of holding submerged track in place is to drive piles along the inside of the rail every fifteen feet.

The method I would use in getting track into place quickly would be to crib up with old ties or bridge stringers, that is where the holes are short and deep. But where a place is washed out two or three hundred feet I would cut out the high places and level down the dump so the ties would have a good bearing. This method with some cribbing can be used at approaches of bridges.

It's a very hard proposition to do anything with water when it cuts through the dump, as it always has a strong current and would wash out almost anything that could be put in. I think the quickest way to repair a washout where there is a strong current is to drive piles and bridge it.

Personals

D. W. Whisner has been appointed supervisor of track, Baltimore & Ohio R. R., at Clarksburg, W. Va.

F. J. Ellis has been appointed roadmaster of the Canadian Northern Ry., at Winnipeg, Man.

E. B. FINNESSEY, Roadmaster, Great Northern Ry.

George Peck has been appointed roadmaster of the Canadian Pacific Ry., at Calgary, Alb., succeeding T. Bradshaw.

R. W. Mumford has been appointed supervisor of track of the Chesapeake & Ohio Ry., at Logan, W. Va.

H. Rasmussen has been appointed roadmaster of the Chicago & North Western Ry., at Marinette, Wis., succeeding G. A. Clewly.

L. Anderson has been appointed roadmaster of the Chicago, Milwaukee & St. Paul Ry., at Mason City, Ia. J. J. Clune has been appointed roadmaster at Aberdeen, S. Dak. J. F. Larson, roadmaster, has been transferred from Cologne to Glencoe, Minn., effective March 8. George Moe has been appointed roadmaster at Sioux Falls, S. Dak., effective April 5. M. Murphy has been appointed construction roadmaster at Perry, Ia., in charge of maintenance and second track construction between Perry and Marion, Ia.

J. B. Pugh has been appointed roadmaster of the Chicago, Rock Island & Pacific Ry., at Atlantic, Ia., succeeding T. H. O'Brien, transferred to Des Moines, effective April 25.

S. McPheron, supervisor of track of the Cincinnati, New Orleans & Texas Pacific Ry., has been transferred from Stearns to Somerset, Ky., succeeding J. Bradley. J. G. Spradlin has been appointed supervisor of track at Stearns, Ky., succeeding S. McPheron.

Jose Iglesias has been appointed roadmaster of the Cuba R. R., at Alto Cedro, Oriente, Cuba, succeeding H. A. McKey.

L. F. Wheelon has been appointed roadmaster of the Denver & Rio Grande R. R., at Salida, Col., succeeding R. Hughes, effective May 7.

R. Roberts has been appointed roadmaster of the Elgin, Joliet & Eastern Ry., at Joliet, Ill., effective April 15.

P. Cunningham has been appointed supervisor of track of the Erie R. R., at Youngstown, O., succeeding J. Jordan. O Pratt has been appointed supervisor of track at Lima, O., succeeding P. H. Farrell. C. R. Smith has been appointed supervisor of track at Binghampton, N. Y., effective May 12.

A. S. Ward has been appointed supervisor of track of the Georgia, Florida & Alabama Ry., at Bainbridge, Ga.

E. B. Finneseey, who was appointed roadmaster of the Great Northern Ry., at Marcus, Wash., March 27, has been in the service of the Great Northern Ry. for a number of years, for the last five years in the capacity of assistant roadmaster.

AUG. W. WEHMER, Roadmaster, Morgan's Louisiana & Texas Ry.

A. Anderson has been appointed assistant roadmaster of the Great Northern Ry., at Wilson Creek, Wash., succeeding J. Mohr, effective April 28. M. Gillen, assistant roadmaster, has been transferred from Marcus, Wash., to Chewelah, Wash. J. Goodrie, assistant roadmaster, has been transferred from West Gretna, Mont., to Grafton, N. D. C. Holm, assistant roadmaster, has been transferred from Aneta, S. D., to Oroville, Wash., succeeding J. A. Nelson. P. Jensen has been appointed assistant roadmaster at Superior, Wis., succeeding Ed. Donley. J. T. Koehen, assistant roadmaster, has been transferred from Hannaford, N. D., to New Rockford, N. D. A. Larson has been appointed assistant roadmaster at Great Falls, Mont., effective April 1. Paul Montgomery has been appointed assistant roadmaster at Minneapolis, Minn., effective April 1. H. Wolk has been appointed assistant roadmaster at Everett, Wash., succeeding E. C. Carter.

J. R. Edwards has been appointed general inspector of motor cars, of the Lehigh Valley R. R., office at South Bethlehem, Pa.

H. W. Scott has been appointed roadmaster of the Lorain, Ashland & Southern R. R., at Jeromeville, O.

W. L. Hesterly, formerly with Morgan's Louisiana & Texas Ry., has been appointed roadmaster of the Louisiana Western R. R., at Lake Charles, La., succeeding L. Lawler.

C. H. Mitchell has been appointed supervisor of the Louisville & Nashville R. R., at London, Ky., succeeding A. Taylor.

J. D. Hitchcock has been appointed roadmaster of the Missouri Pacific Ry., at Marianna, Ark.

J. Johnstone has been appointed supervisor of track of the Minneapolis & St. Louis R. R. at Marshalltown, Ia., succeeding J. Laughlin. T. J. Mara has been appointed supervisor of track at Conde, S. D.

C. B. Petticrew, who was appointed roadmaster of the Missouri Pacific Ry., at Auburn, Neb., April 1, 1913, as was announced in the May issue of *Railway Engineering*, entered railway service in 1904 as a track man on the Big Four Ry. Later in the year he was made a rodman, leaving in 1905 to attend Purdue university. During the summers of 1906, 1907 and 1908, he was employed by the Big Four as levelman, by the Cincinnati & Hamilton Traction Co., as concrete foreman, and as foreman for a paving contractor. After graduating in 1909, he entered the service of the Missouri Pacific Ry. as ballast and track inspector, and in 1910 was appointed assistant engineer, which position he held until his recent appointment as roadmaster at Auburn, Neb.

August W. Wehmer has been appointed roadmaster of the Lafayette district of Morgan's Louisiana & Texas R. R., at Lafayette, La., succeeding W. L. Hesterly, effective May 1.

B. H. Allmain has been appointed roadmaster of the Northern Pacific Ry., at Seattle, Wash., succeeding F. M. Smith, promoted. D. McLaughlin, formerly roadmaster, has been appointed general roadmaster at Pasco, Wash. R. G. Knight, roadmaster has been transferred from East Grand Forks, Minn., to Staples, Minn., succeeding P. McGuire. J. Nester has been appointed roadmaster at East Grand Forks, Minn., succeeding Mr. Knight. T. J. Tyler, formerly roadmaster, has been appointed general roadmaster at Seattle, Wash.

O. M. Barlow, roadmaster of the Southern Pacific R. R., has been transferred from South Vallejo, Cal., to Mina, Nev., succeeding Jos. Greiler, who has been transferred to Carlin, Nev. He succeeds T. McKenna, who has been transferred to South Vallejo, Cal. R. G. Bosworth has been appointed roadmaster at Benson, Ariz., succeeding Jno. Ford, transferred to Bowie, Ariz.

J. H. Brown has been appointed roadmaster of the Union Pacific R. R., at Kansas City, Mo., succeeding F. Ratcliff. J. P. Hopkins has been appointed roadmaster at Onaga, Kan., succeeding A. V. Sanders, effective April 15. C. C. Ramsdell has been appointed roadmaster at Northport, Neb., succeeding L. Hadeon.

New Literature

The Central Electric Company, Chicago, has issued the May, 1913, number of Electron, an attractive little booklet given over to electric wiring and lighting. A number of interesting articles appear, the booklet being considerably more interesting than a catalogue on this account. There is an extensive and well illustrated article on the indirect lighting of the five-hour train of the New York, New Haven & Hartford R. R. from Boston to New York, which is of more than ordinary interest.

S. M. Vauclain, vice-president of the Baldwin Locomotive Works, has lately been elected a director of the Bucyrus Co.

The New York Central & Hudson River has taken bids on a 400-ton bridge to be erected at Spuyten Duyvil, N. Y.

The Atlanta, Birmingham & Atlantic has ordered 5 locomotives from the Baldwin Locomotive Works.

The Chesapeake Western has ordered one consolidation freight locomotive with 19x24 in. cylinders, driving wheels 52 ins. in diameter and a total weight of 132,000 lbs. in working order, from the Davenport Locomotive Works.

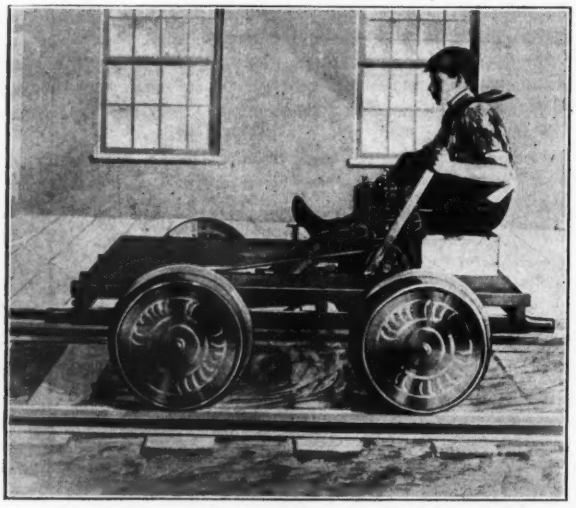
With The Manufacturers

KEROSENE HAND-CAR ENGINE.

A hand-car engine which uses kerosene is now being placed on the market. While the engine is designed for using kerosene, the makers claim it will operate on any liquid fuel such as gasoline, distillate, petrol, paraffine or alcohol without any change of equipment. The cost of kerosene is appreciably less than gasoline in most sections of the country, and this fact is responsible for the design of the kerosene engine described herein.

It is also quite possible that in some sections of the country it is much harder to obtain gasoline than the other oils which are mentioned. An engine which will burn any kind of oil is not very liable to ever run out of operating fuel where more cannot be obtained.

The driving mechanism used in this kerosene track car engine is of the simplest kind. The engine itself is arranged to be mounted on the two main center cross beams of the car and is equipped with a 3" flanged pulley. On the front axle of the car is fitted the mate to this pulley, which is a 14" x 3" split



Detroit Kerosene Engine Installed on Handcar.

steel flanged pulley. The engine drive pulley is connected direct to this by means of a 3" leather belt, which runs loose. To the outside of this belt a long lever handle is set, on the lower end of which is a small idler or tightener pulley.

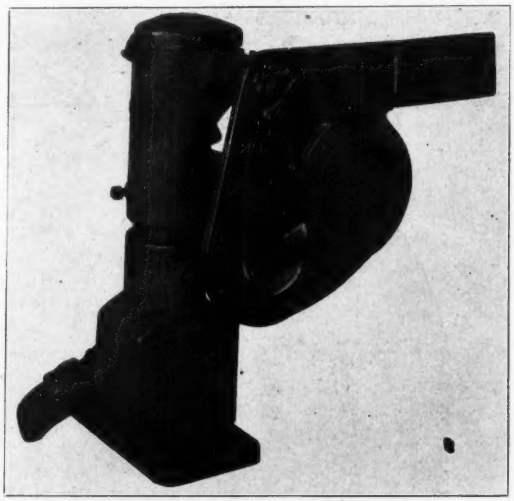
The engine is started entirely without load and when ready to start all it is necessary to do is to draw the main lever down slowly. The upward pressure on the belt can be made as light or heavy as desired. A light pressure will give slow speed and a heavy pressure a high speed. In this way any speed required may be attained simply by manipulating the hand lever. A very heavy load can be started without pushing by starting with a very light pressure on the belt and gradually increasing it.

This kerosene engine is a two-cycle engine. It has but three moving parts, with but one adjustment for wear. The track car engine is made special, and is hopper cooled, thus doing away with the weight which would accrue from the use of the ordinary water cooling attachment. The engine works equally well in either direction; the reverse is made by simply throwing the lever over in the opposite direction.

This hand-car engine, it is said, is the only one now being manufactured which operates on kerosene oil. It is being placed on the market by the Detroit Engine Works, Detroit, Mich.

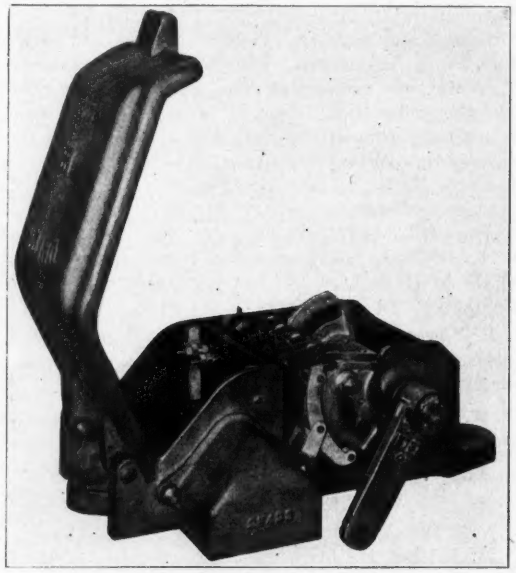
UNIVERSAL SWITCH CIRCUIT CONTROLLER AND MECHANICAL DWARF SIGNAL.

The instrument shown in the illustration is a modification of the universal switch circuit controller which the Union Switch & Signal Co. has had on the market for several years. In the present instrument the method of adjustment has been improved so as to insure great accuracy and permanence. Each cam arm



U. S. & S. Co. R. S. G. Mechanical Dwarf Signal.

carries a pinion which meshes in a rack cut on the inner face of the slot in the quadrant, thus affording a micrometer adjustment. As in the former design, the contacts are "interlocked" by the quadrants, so that when any quadrant is in a position corresponding to that of the outer one in the illustration, its contacts cannot be moved in either direction. Instruments of this type are furnished with contacts operating in two or three positions, as desired. The former are suitable for shunting the track and opening signal circuits in automatic block signal



U. S. & S. Co. Switch Machine.

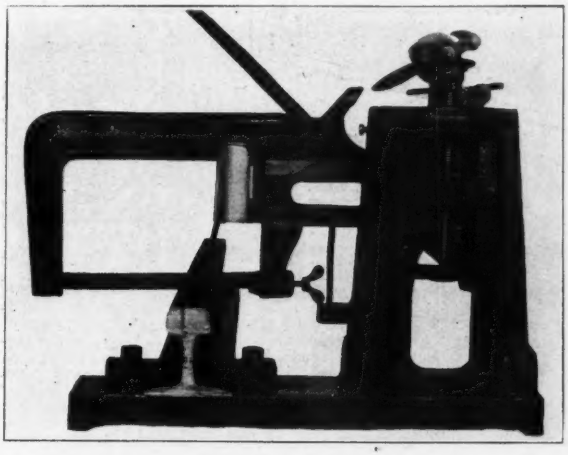
installations, the latter for selecting circuits, chiefly at interlocking plants. The box shown in the illustration has had part of its side cut away in order to afford a better view of the internal arrangement.

The dwarf signal shown in the photograph is the same as that illustrated on Railway Signal Association Drawing 1097. The operating connection can be brought from any direction to the signal, placed on either end of the shaft, and the upper section may be set at any angle with respect to the base. The signal shown operates between 0° and 45° only, and is arranged for pipe connections; it can, however, be made to work from 0° to 90° and to operate by either pipe or wire. This signal was exhibited at Chicago during the National Railway Appliances Show.

FLESTER RAIL SAW.

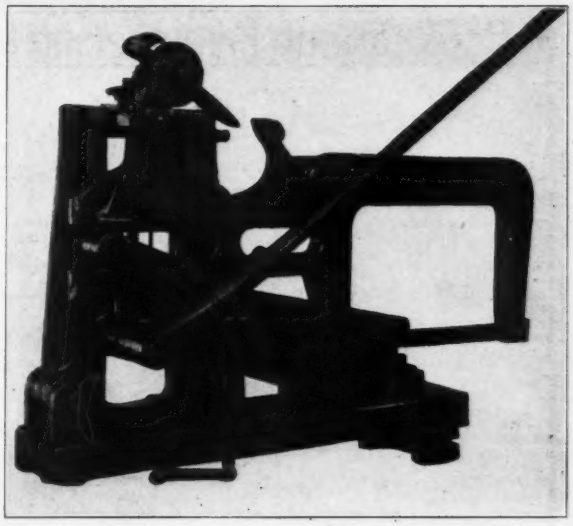
A new rail saw has been placed on the market by Flint & Chester, 237 Lafayette street, New York. This saw, which is illustrated herewith, embodies many features which are of considerable importance in rendering it fool-proof and efficient in operation.

While somewhat heavier in design than other saws, it is stated that two men can carry it by means of a ring at the top through which the handle is inserted. The feed is automatic and is adjustable, and as long as the track foreman can see the men working the handle back and forth he knows that they are cutitng the rail, as the feed is positive. The saw cuts accurately at right angles with a clean cut. This allows a joint to be made as close as with new rails.



Flester Rail Saw Ready to Start Cut.

The saw is simple in construction and can be set up by track men without the assistance of tools other than a wrench and screwdriver for adjusting the blade. The saw is, of course, arranged so that it can be swung back out of the way of trains without making readjustment necessary.



Flester Rail Saw, Cut Completed.

Industrial Notes

The Mann-McCann Co., Transportation Bldg., Chicago, has recently received an order for spreaders amounting to between $30,000 and $40,000 from the Baltimore & Ohio R. R. This is the largest order for machines of this class ever placed by a railway.

The Engineering Construction Co. has been organized, with offices at 106 North La Salle St., Chicago, Ill., to do a general engineering and contracting business. The officers are: I. J. Crowley, general manager; E. A. Clark, chief engineer, and Jas. X. Gunning, secretary and treasurer.

A. T. Enlow has resigned as manager of sales of the Stark Rolling Mill Co. to become associated as a partner with the Pedler People, Oshawa, Ont.

Chas P. Howard and Shelby S. Roberts, members of the American Society of Civil Engineers and American Railway Engineers and American Railway Engineering Association, announce the opening of an office in the Transportation building, Chicago, for the general practice of civil engineering. They will specialize in railway, yards and terminal surveys, location, plans, estimates, valuations and studies of economics of operation as affected by grade and line improvements.

A. O. Hiester, manager of the Buffalo office of the United States Light & Heating Co., and previously with the National Battery Co., has joined the sales force for the Edison Storage Battery Co., Orange, N. J.

The Horace L. Winslow Co. has recently found it necessary, on account of expansion resulting from increase of business, to move into new and larger offices at 990 Old Colony Bldg., Chicago.

Hiram J. Slifer, consulting civil engineer specializing in steam railway practice, announces the removal of his office from 209 S. LaSalle street to The Rookery building, Chicago, Ill.

H. B. Underwood & Co., Philadelphia, Pa., manufacturers of portable tools, announces a change of management. Morris G. Condon, having purchased the other interests will continue the business with the assistance of David C. Hitchner, Hiram D. Griffith, Charles O. Ralph and Samuel I. Earl.

Oscar C. West, Peoples Gas Bldg., Chicago, has been appointed an agent for the Steel Concrete Construction Co., Pittsburgh.

The Consolidated Railway Electric Lighting & Equipment Co. has moved its Chicago office to room 1106, Karpen building, 900 South Michigan avenue.

W. E. Holloway and P. W. Holstein have resigned their positions with the Jeffrey Manufacturing Co., Columbus, Ohio, to go to the Roberts & Schaefer Co., Chicago. W. E. Holloway has been with the Jeffrey Co. for 9 years. He will have charge of the marketing of the new Marcus combination screen and picking conveyor which the Roberts & Schaefer Co. has recently acquired. P. W. Holstein has been associated with the Jeffrey Co. for the past 21 years. During a large portion of this time he was contracting engineer on coal tipple and coal washing plant construction. He will have charge of this branch of the Roberts & Schaefer Co.'s business, principally in the West Virginia field.

Recent Engineering and Maintenance of Way Patents

SIGNALING SYSTEM.

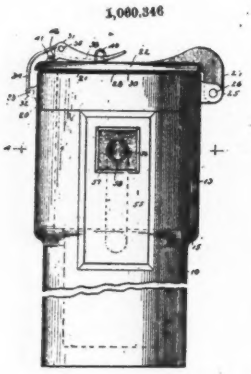
1,060,118—T. H. Patenall and H. S. Young, assignors to Union Switch & Signal Co., Swissvale, N. Y.

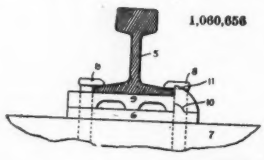
In combination, two staff instruments, a magnet for each instrument each comprising a local coil and a line coil, a battery and a pole-changer for each instrument, a circuit for the local coil of each instrument, and a circuit for the line coil of each instrument. A push button is provided in each instrument, and two circuit controllers operated thereby one of which is included in the circuit of the line coil for the corresponding instrument and is normally open, and the other of which circuit controller is adapted to connect the battery and pole-changer of the corresponding instrument with the local coil of the same instrument or with the line coil of the other instrument, and is normally in position to effect the last mentioned connection. Means in each instrument actuated by the insertion of a staff in and also by the removal of a staff from the instrument is provided for reversing the pole-changer of that instrument.

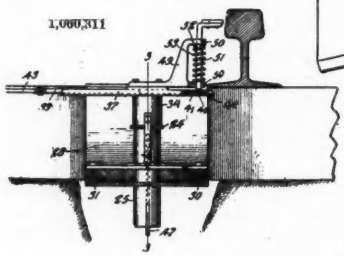
TONGUE SWITCH.

1,060,183—M. J. Henehan, Seattle, Wash.

The combination of a base including a recessed wearing plate, a switch-tongue having its heel portion seated in the recess of the plate, a slotted pin extending downwardly from the tongue heel into the base subjacent to the wearing plate thereof, a tapered key extending into the pin slot and coacting with the underside of the wearing plate to maintain the tongue against the wearing plate, and means carried by the pin whereby the key may be adjusted for taking up the wear occurring at the tongue heel.



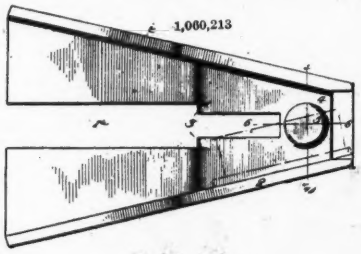


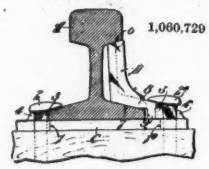


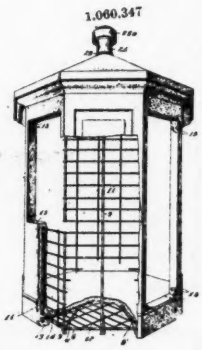
CAR REPLACER.

1,060,213—W. M. Robbins, Bluefield, W. Va.

A car replacer comprising a body portion having a longitudinal slot, forming side portions, and a bridge portion connecting the side portions at one end of the slot, the upper face of the bridge portion being above the adjacent side portions and the under face of the bridge portion being recessed and convex from end to end.



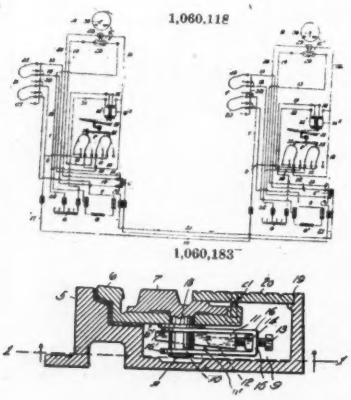


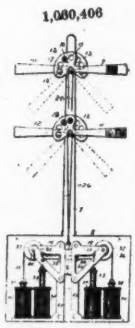


RAILWAY SIGNAL.

1,060,311—J. H. Body and F. T. Leftwich, Roanoke, W. Va.

This device consists of an electric circuit, a signal comprising a yieldable base, a cartridge receptacle supported by the base, an elongated guide member supported by and inclosing the upper end of the casing, a bracket supported centrally of the guide and having a portion disposed above one end thereof, a hammer mounted in the bracket, a spring actuated follower within the casing for automatically moving the cartridges into the guide, an ejector finger movable in the guide in the direction of the hammer, and means for actuating the ejector finger.





BATTERY WELL.

1,060,346—C. F. Massey, Chicago, Ill.

The combination of a body part open at its upper end, a band surrounding the body part adjacent the upper end, a door hinged to the band to be swung against the band to close the open end, a spring plate hinged at one end to the band, a hasp hinged to the other end of the spring plate, a staple on the cover for receiving the hasp, an abutment lug on the cover, an abutment extension on the hasp for engaging with the abutment lug when the hasp is brought into engagement with the staple, the engagement of the hasp with the abutment lug and staple causing the spring to be expanded to press the hasp against the cover to thereby lock the cover firmly in closed position, and a gasket carried by the cover to be interposed between the cover and the band when the cover is in closed position.

RAILWAY BOOTH OR SHANTY.

1,060,397—C. F. Massey, Chicago.

The combination of a small horizontally disposed top ring, a plurality of larger rings disposed one above the other below the top ring and concentric therewith, gable bars secured to the top ring and to the uppermost of the lower rings to form a skeleton roof structure, vertical bars secured to the larger rings, floor bars extending upwardly a distance from the lowermost of the larger rings and deflecting radially inwardly to form a skeleton floor structure, and mesh material applied to the roof and floor bars and to the vertical bars. The rings, bars and mesh material form a skeleton booth, and cementitious material is molded about the skeleton frame work, and a ventilator frame removably inserted in the top ring.

ELECTRIC SIGNAL.

1,060,406—A. J. Allard, Richmond, Va.

The combination with a standard and a signal mounted thereon to swing, of a longitudinally movable bar, connections between the bar and signal, a lever connected with the bar, locking means for the bar controlled by the lever, electro-magnetic devices connected with the lever for actuating the same in one direction to withdraw the locking means, and electro-magnetic devices connected with the lever to move the bar downwardly and project the locking devices.

RAIL SHIM.

1,060,656—H. C. Woodbridge, Rochester, N. Y.

A rail-shim adaptable to be introduced between a tie-plate and the base of a rail, the shim having, on its lower surface, a recess shorter than the shim and adapted to receive the flange of the tie-plate, and, on its upper surface, an abutment having a rail-engaging surface which lies in the same vertical plane as the inner surface of the flange.

COMBINED TIE PLATE AND RAIL ANCHOR.

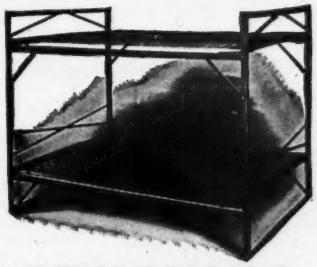
1,060,729—W. H. Winworth, assignor to Columbus Railway Supply Co., Columbus, O.

A combined tie plate and rail anchor comprising a rail-supporting member on which the rail rests, a rail-gripping member having a wedge-shaped portion that is adapted to be wedged between the head and the base flange of the rail and provided with a rigid laterally projecting portion, a depending flange on the laterally projecting portion extending along one edge of the base flange of the rail and having oppositely inclined surfaces, and upwardly projecting lugs on the rail-supporting member that co-operate with the oppositely inclined surfaces to prevent longitudinal movement of the rail.

The American Blower Co., Detroit, Mich., announces that William C. Redfield, having been appointed a member of President Wilson's cabinet, has deemed it advisable to terminate his business connections, and therefore has resigned as vice-president and director of the American Blower Co., and has retired from active participation in the management of the company.

The Bogardus Co., manufacturer of pressure gages, has found it necessary to enlarge its facilities, owing to increasing business, and has moved from 159 W. Huron St., Chicago, to 224-230 West Huron St.

Give Your Men Needed Rest When Sleeping

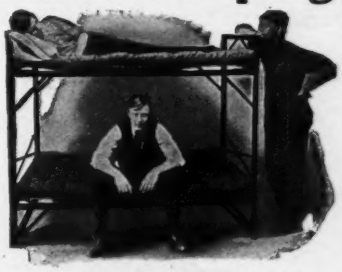


No. 185 "Tiger" Double Deck Bunk Set Up.

And be Repaid Threefold Through

Increase in Work Done—
Better Class of Men Secured—
Lower Ultimate Cost of Equipment

The "Tiger" Steel Bunk is a Permanent Investment. Built to stand all kinds of Hard Knocks —It's Bug Proof.



Showing Head Room, Height, Etc.

"Tiger" Steel Bunks

Made in either Double or Single Deck — All Sizes.

Write us for Illustrated Circular Showing Styles and Prices.

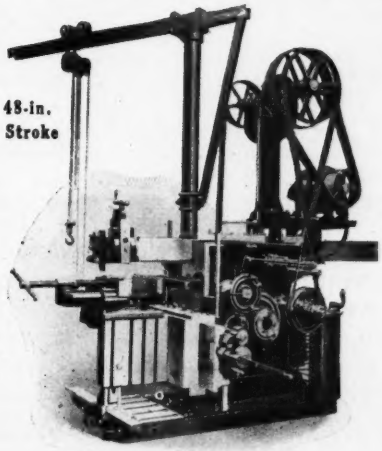
The spring fabric, though elastic, can never sag—made with wire link fabric, secured to frame by oil tempered helical springs—CANNOT BREAK DOWN.

Six men weighing about a half ton did not injure this Bunk after giving it the above unusual, unfair test.

Haggard & Marcusson Co.

1120 West 37th Street Chicago, Ill.

A Machine for the ENGINEERING Department



48-in. Stroke

MORTON SPECIAL DRAW CUT FROG AND SWITCH SHAPER

IT is BUILT ESPECIALLY FOR THE WORK and has a SPECIAL HEAVY VISE for HOLDING RAILS FOR NOTCHING.

The STRONGEST, Most POWERFUL and EFFICIENT SHAPER BUILT.

Some of the large Manufacturers of Frogs and Crossings have from TWO to SIX of these machines in operation.

The railways which operate the largest frog and crossing plants have found that the work of these shapers is such as to make them indispensable.

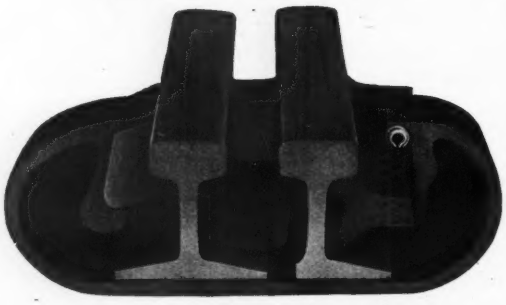
BUILT and guaranteed by THE SAME COMPANY which makes the SPECIAL 32" RAILROAD DRAW-CUT SHAPER.

MORTON MFG. CO., Muskegon Heights, Mich.

Write for Bulletin Number Ten

ESTABLISHED 1882

THE WEIR FROG COMPANY

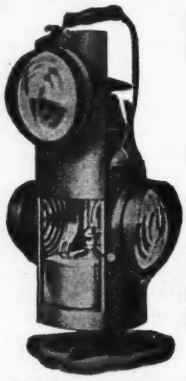


WEIR TITANIUM CLAMP
Design No. 5—Patented

Rail and Manganese Track Work

CINCINNATI, OHIO

BROADWAY CENTRAL HOTEL
Broadway, corner Third Street
IN THE HEART OF NEW YORK
Only Medium Price Hotel left in New York.
Special attention given to ladies unescorted
SPECIAL RATES FOR SUMMER
OUR TABLE is the foundation of our enormous business.
AMERICAN PLAN, $2.50 UPWARDS
EUROPEAN PLAN, $1.00 UPWARDS
Send for Large Colored Map of New York, FREE.
DAN. C. WEBB, Proprietor
The Only New York Hotel Featuring American Plan
Moderate Prices. Excellent Food. Good Service.


Round Body Steel Switch Lantern

LANTERNS
SWITCH, ENGINE, SIGNAL, SEMAPHORE, MARKER, STATION, Etc.
CHIMNEYLESS BURNERS
for one day and long-burning service
30 YEARS' EXPERIENCE
New and specially equipped factory enables us to fill large orders promptly and at fair prices.
Illustrated catalogues on request.
PETER GRAY & SONS, Inc.
Mail Address: "Cambridge", BOSTON, MASS.
Chicago Office: 303 Great Northern Bldg.
JOSEPH M. BROWN, Representative.

The Massee Country School
Lawrence Park, Bronxville, New York
Telephone, 257 Bronxville

A boarding and day school for boys from 6 to 19 years.

Located in beautiful Westchester County, thirty minutes from New York City.

Junior Department prepares thoroughly for Hill, St. Paul's, Exeter, and for all large boarding schools.

Senior Department prepares for all the leading colleges, scientific schools, West Point, and Annapolis.

Real individual instruction; classes limited to six members.

Bright pupils not retarded. Backward pupils not discouraged and properly graded.

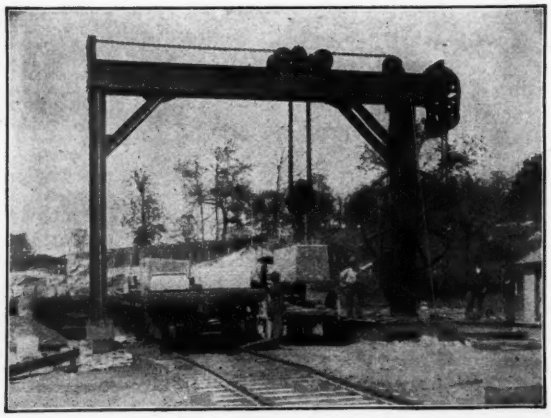
Teachers all college graduates of at least three years' experience.

Exceptional facilities for athletic sports and all forms of outdoor life under the supervision of the Masters.

A prominent Wall Street Attorney writes: "From your excellent methods my son did substantially two years' work in one at your school, thus entering college one year ahead of time."

A Princeton Professor writes: "Some of our finest Princeton students were former pupils of yours." For illustrated catalog, address

W. Wellington Massee, Ph. D.
Box 200 - - - Bronxville, N. Y.



Brownhoist Bridge Crane

is an inexpensive and durable machine for handling all heavy loads from car or wagon with just one or two men. Being equipped with safety appliances, it practically eliminates all danger to the men.

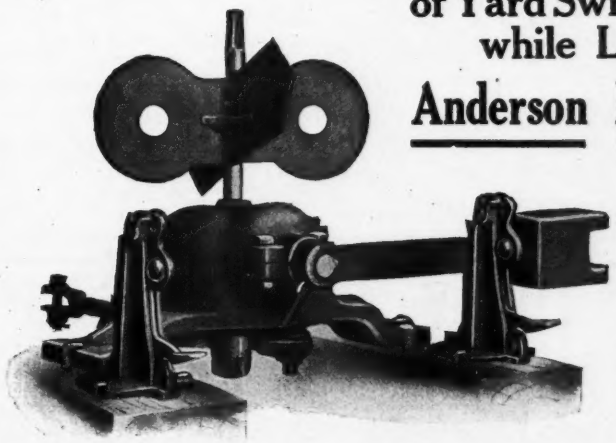
Write for our new catalog J on bridge cranes.

THE BROWN HOISTING MACHINERY CO.
CLEVELAND, OHIO
New York Pittsburgh Chicago San Francisco

$16\frac{2}{3}$ CENTS Maximum Maintenance Cost

of Yard Switches that are Run Through while Latched if you use the

Anderson Economy Switch Stand



This stand for yard switches, is provided with a special 3 way crank arm made of malleable iron. This 3 way crank arm is designed that when switch is run through, one of the arms to which the switch is connected will shear off, without damage, to any part of the switch mechanism.

The switch can be quickly placed in order by connecting the rod to one of the other arms. When the three arms are destroyed a new three way crank can be applied. These are furnished at 50 cents each. This feature is not new.

Over 30,000 Economy switch stands with this special 3 way crank, in service on many railroads.

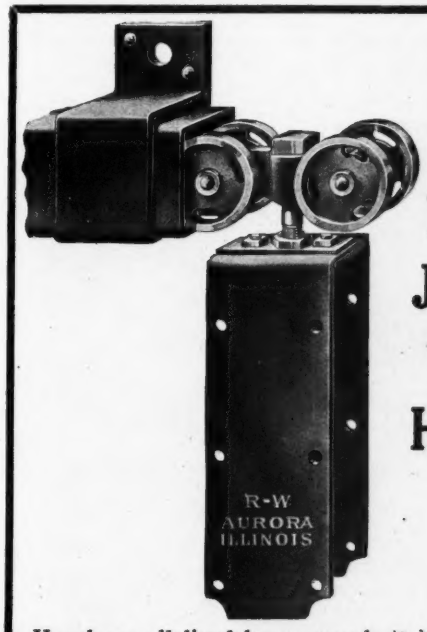
Nonbreakable cranks are furnished for main line switches.

Full Details and Description of This Switch Stand in Our Catalogue. Write for It

MANUFACTURED EXCLUSIVELY BY

THE AMERICAN VALVE AND METER COMPANY

CINCINNATI, OHIO



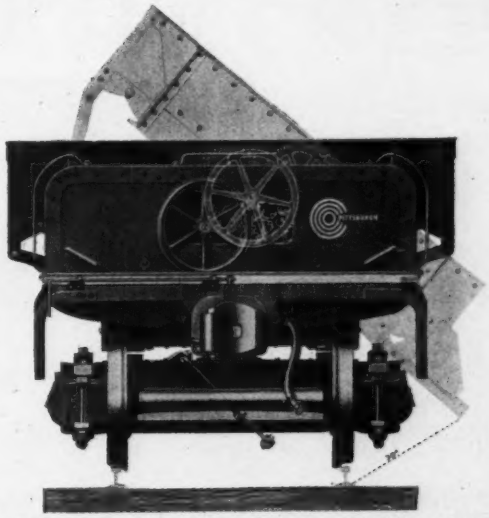
No. $150\frac{1}{2}$ B Jumbo Door Hanger

You have all lived long enough to know that competing articles made to fulfill the same need vary in their extent of filling that need. Some fill it half ways; some three-quarters; some all the way. Specify **RICHARD-WILCOX** Door Hangers; they fill the need all the way.

Architect's Catalog No. 10 on Request

Richards-Wilcox Mfg. Co.

125 THIRD STREET AURORA, ILLINOIS



CLARK EXTENSION SIDE DUMP CARS

SUPPORT THE DOORS THROUGHOUT THEIR LENGTH. OPEN THEM TO WHERE THEY PROTECT THE TRUCKS AND TRACK AND LEAVE CLEAR SPACE ABOVE TO DISCHARGE THE LOAD

4 TO 7 YARDS ON FOUR WHEELS — 12 TO 20 YARDS ON EIGHT WHEELS

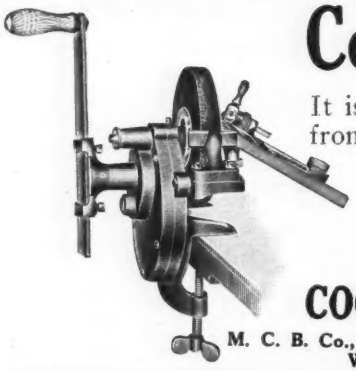
HAND OR AIR DUMP, OR BOTH

FOR SALE OR LEASE. PROMPT DELIVERY

STEEL CONSTRUCTION — WOOD LINING IF DESIRED

CLARK CAR COMPANY

2121 OLIVER BLDG. PITTSBURGH, PA.



Cook's Magic Tool Grinder

It is geared high. The gears are all enclosed, and are kept free from dirt. The patented holder makes it possible for any laborer to correctly sharpen a drill bit; simply place the bit in the holder and swing to and fro against the wheel. The holder can be adjusted to give any clearance to the bit point.

Complete description in our catalogue—Write for it.

COOK'S STANDARD TOOL CO., KALAMAZOO, MICH. U. S. A.

M. C. B. Co., McCormick Bldg., Chicago — Western Agents

Space 51, Coliseum

H. M. BUCK, 30 Church St., N. Y. — Eastern Agents

THE JOHNSON CAR REPLACER

Range and capacities of the different types are as follows:

		If Not Over	Capacity.	Throat Opening.	Wt. Each.
Type M for rail 12 - 45 lbs.		3½ Inches high	20 Ton Locomotive	2 Ins.	30
Type C for rail up to 65 lbs.		4½ Inches high	30 Ton Locomotive	2½ Ins.	60
Type B for rail up to 80 lbs.		5 Inches high	50 Ton Locomotive	3¼ Ins.	110
Type A for rail up to 100 lbs.		5½ Inches high	80 Ton Locomotive	3½ Ins.	145
Type Z for rail up to 100 lbs.		6 Inches high	100 Ton Locomotive	3½ Ins.	165

THE JOHNSON WRECKING FROG COMPANY, CLEVELAND, OHIO

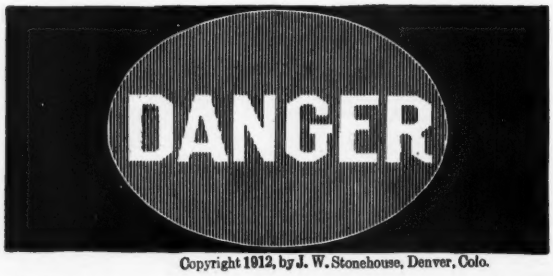
THE MONTHLY OFFICIAL RAILWAY LIST

(The Red List)

IS

THE *READ* LIST

THERE IS NO



Copyright 1912, by J. W. Stonehouse, Denver, Colo.

Of Mistaking the Meaning of This Sign

The word DANGER appears in white on a brilliant red oval set on a black background.

The color combination is striking—it immediately conveys a warning, and its brilliancy and sharp contrasts compel attention.

It is cheaper to install this sign than to install a wooden one; in fact it's cheaper to install a new **Universal** sign than to pay for maintaining an old wooden one. **Universal** signs will not chip, crack, rot or fade, and they are so well protected by the enamel that they will practically never rust. The colors and letters are **burned on,** and they will **stay on.** Weather and smoke does not dim the brilliancy of these signs.

Our manufacturing facilities enable us to make these signs in quantities and allow us to quote surprisingly low prices. These three considerations—the brilliancy and sharp contrasts which compel attention—the durability —and the low price—have set in motion a campaign to make the Universal the **Standard** danger sign. We will be glad to send you, without charge, a full sized print of the Universal in colors, and furnish prices.

We can also quote some very attractive figures on special enameled signs and notices for platforms, crossings, culverts, bridges, waterways, cattle passes, third rails, slow speed sections, whistle posts, yard limits and siding.

Let us figure on your requirements.

The Stonehouse Enameled Steel Sign Company

907 EIGHTEENTH STREET :: :: DENVER, COLO.

The Husky Jerry Boy

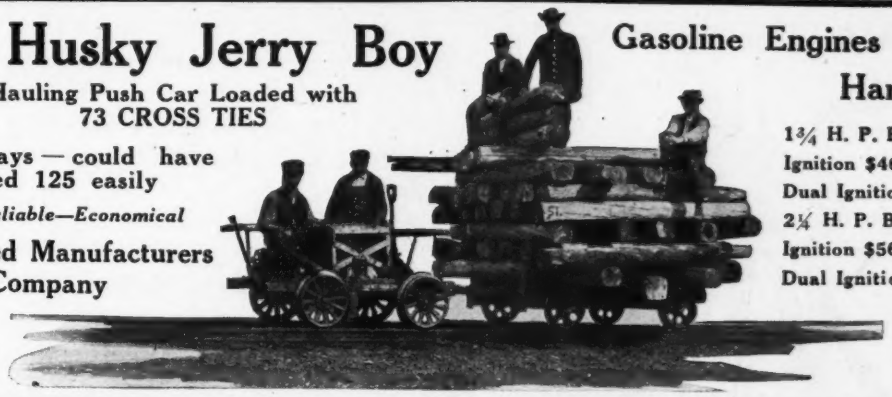
Hauling Push Car Loaded with 73 CROSS TIES

Owner says — could have hauled 125 easily

Safe—Reliable—Economical

Associated Manufacturers Company

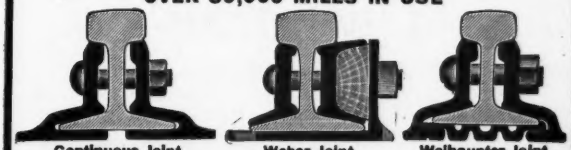
Waterloo, Iowa



Gasoline Engines for Hand Cars

1¾ H. P. Battery Ignition $46.00
Dual Ignition $50.00
2¼ H. P. Battery Ignition $56.00
Dual Ignition $60.00

OVER 50,000 MILES IN USE



Continuous Joint — Weber Joint — Wolhaupter Joint

ROLLED FROM BEST QUALITY STEEL

The Rail Joint Co. General Offices: 185 MADISON AVENUE, NEW YORK CITY

Makers of Base-Supported Rail Joints for Standard and Special Rail Sections, also Girder, Step or Compromise, Frog and Switch, and Insulated Rail Joints, protected by Patents.

CATALOG AT AGENCIES

Boston, Mass.; Chicago, Ill.; Denver, Colo.; Pittsburgh, Pa.; Portland, Ore.: St. Louis, Mo.; Troy, N. Y.

Locomotive Boiler Washout Plants

For Roundhouses

STEAM AND ELECTRIC POWER PLANTS INSTALLED COMPLETE—HEATING AND GENERAL PIPE WORK —OLD PLANTS REPAIRED AND REBUILT

INCREASED ECONOMY AND EFFICIENCY OUR SPECIALTY

As Pioneers in This Line Our Experience Should Be of Value to You

GALE INSTALLATION COMPANY

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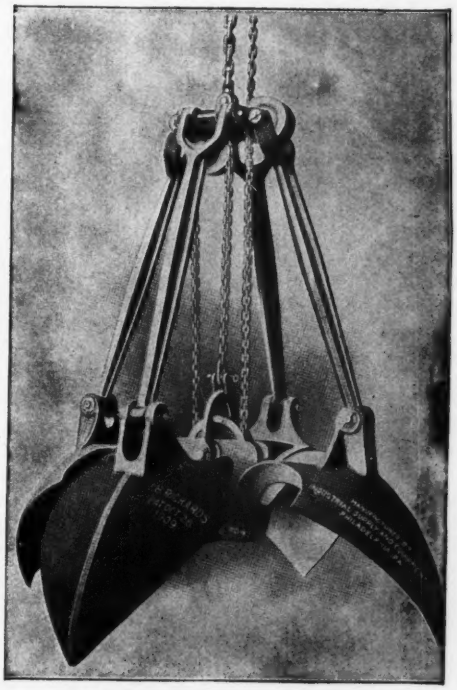

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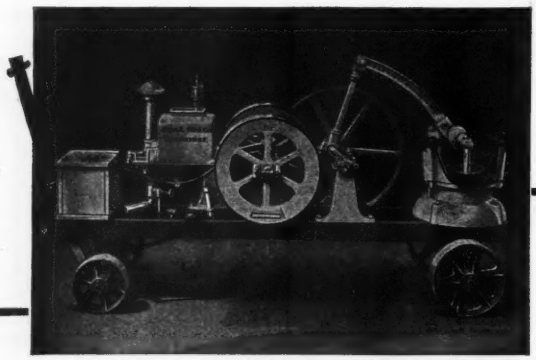

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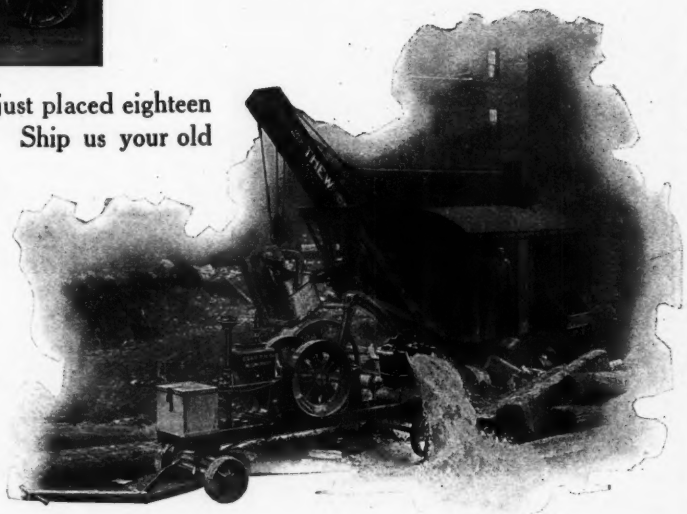

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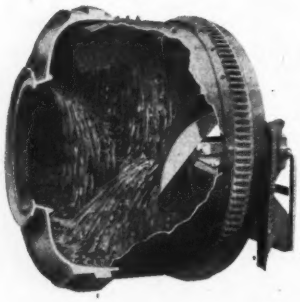

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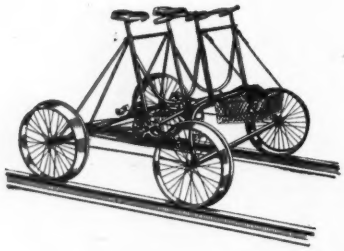

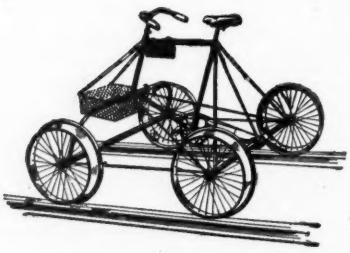

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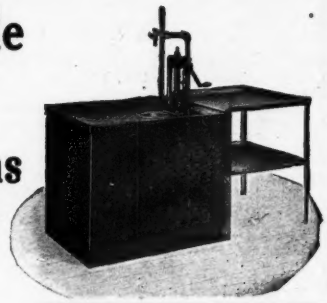

It just fits the conditions at way stations or oil houses for cleaning and filling signal lamps. The pump measures the oil into the lamp and the table catches any dirt or spilled oil. The table serves also as an ideal place for trimming and cleaning the lamps. This is but one unit of the

Bowser Safe Storage Systems

which covers the entire oil storage field.

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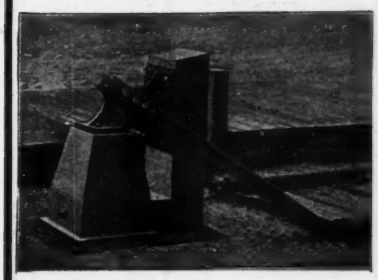

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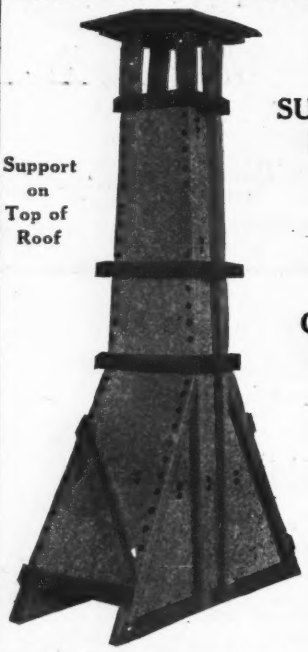

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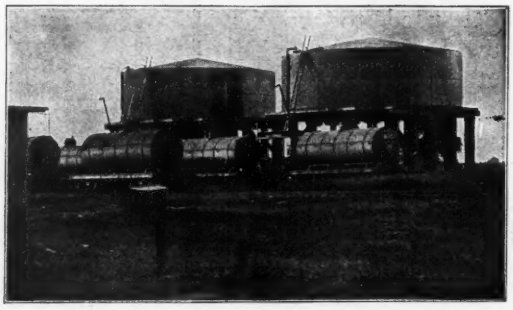

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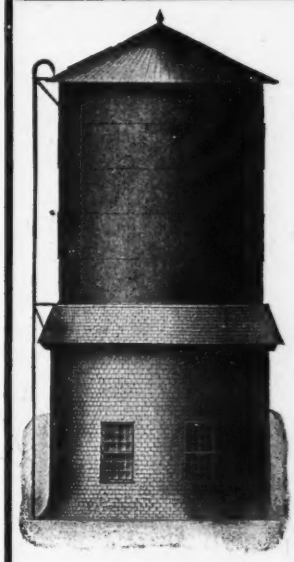

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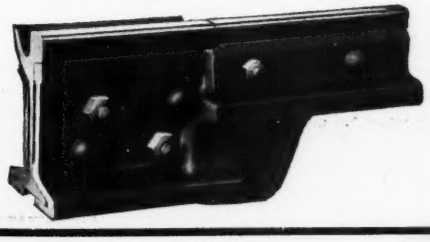

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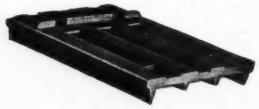

DILWORTH FLANGE PLATE

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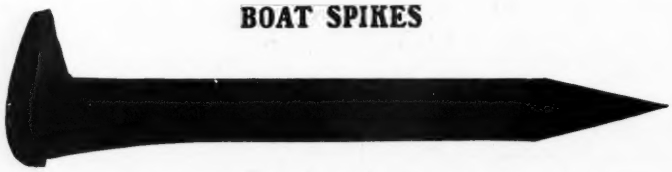

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